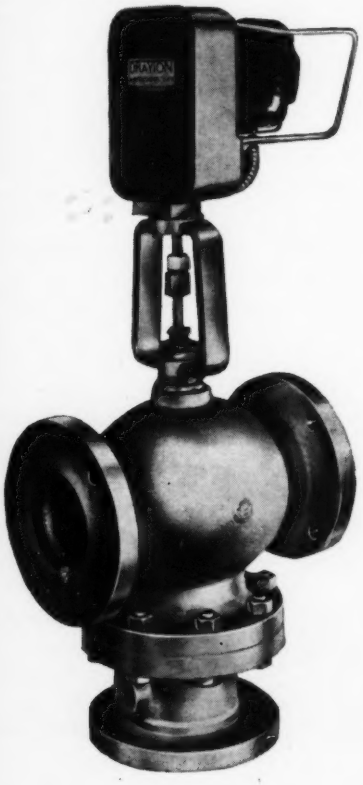
Vol. 15 No. 3 March . 1961 Published Monthly

[illegible] & PHYSICS BUILDING

INSTRUMENT PRACTICE

CONTROL SYSTEMS - ELECTRONICS - AUTOMATION

Drayton Service



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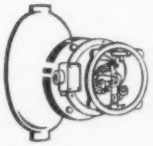

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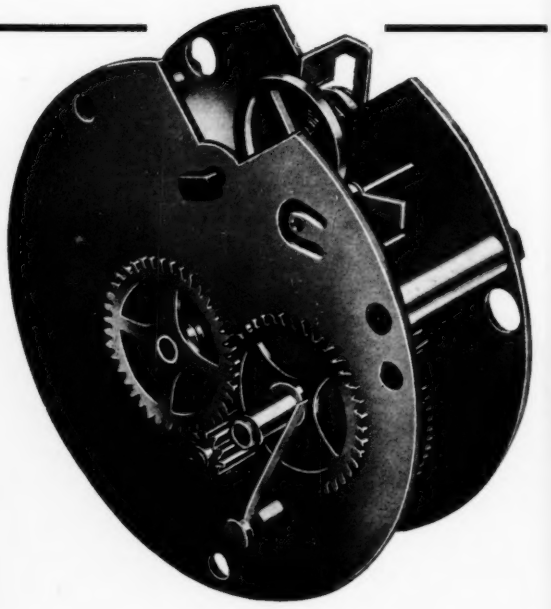

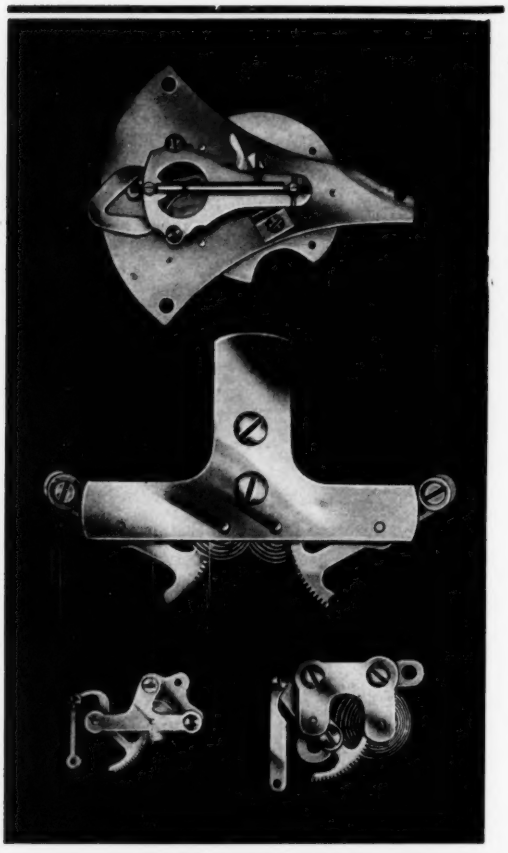

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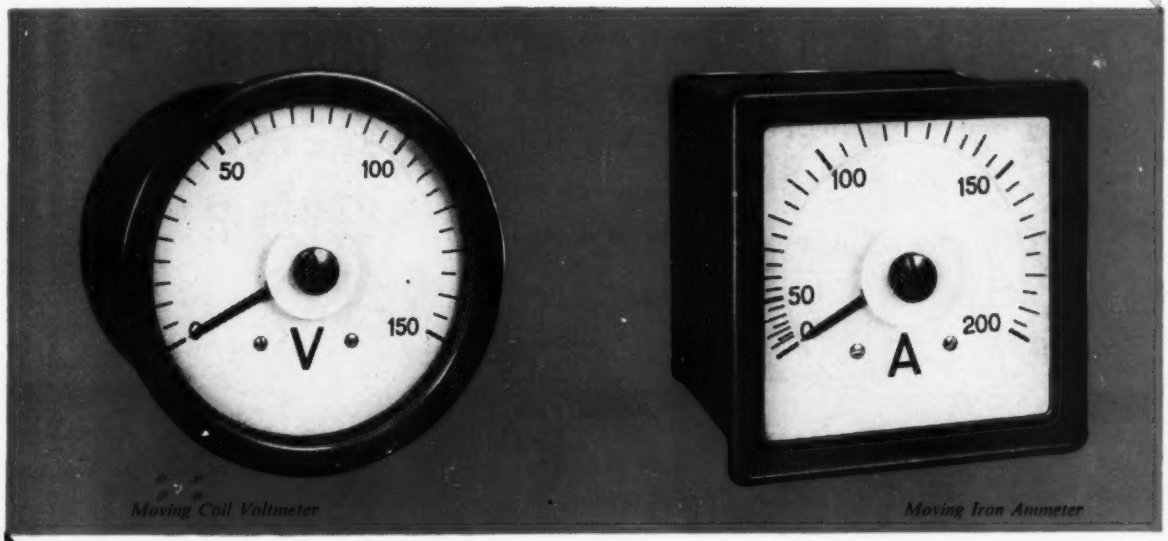

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This range of instruments of advanced design are widely accepted by designers and operators for their long, open scales, good functional appearance and reliability.
Their design permits 'on site' modifications or maintenance without disturbance of the original accuracy. Models are also available for direct wire remote indication.

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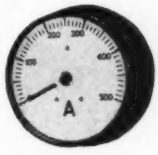

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Round Flush

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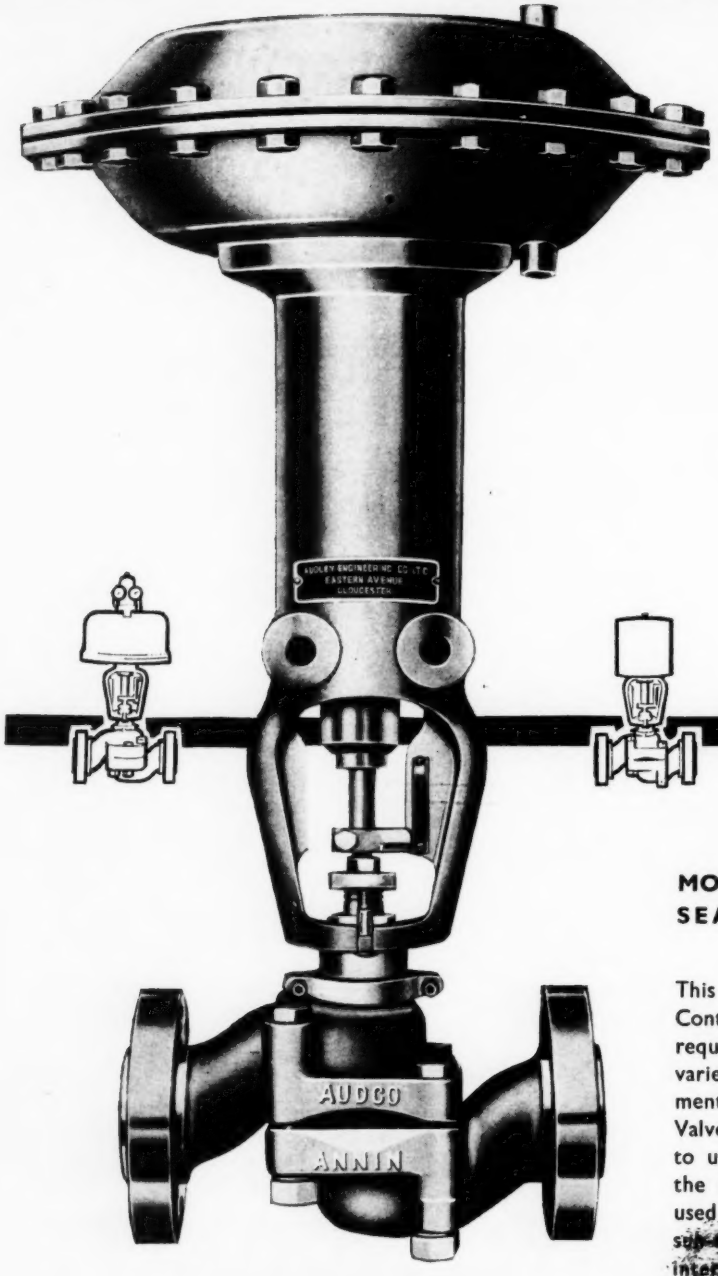

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MODEL 1650 SPLIT BODY SINGLE SEATED DIAPHRAGM VALVE

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AUDCO CONTROL Valves

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A Division of Audco Limited, Newport, Shropshire

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The gauging member is held in a split brass bush so that when wear takes place it may be—

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(b) The worn portion ground off and the unworn portion advanced out of the handle.

The gauging member can thus be fed out like a lead pencil.

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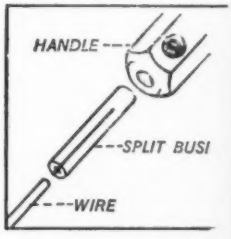
The replaceable and reversible PILOT gauging member is 2" long thus ENORMOUSLY REDUCING gauging costs.



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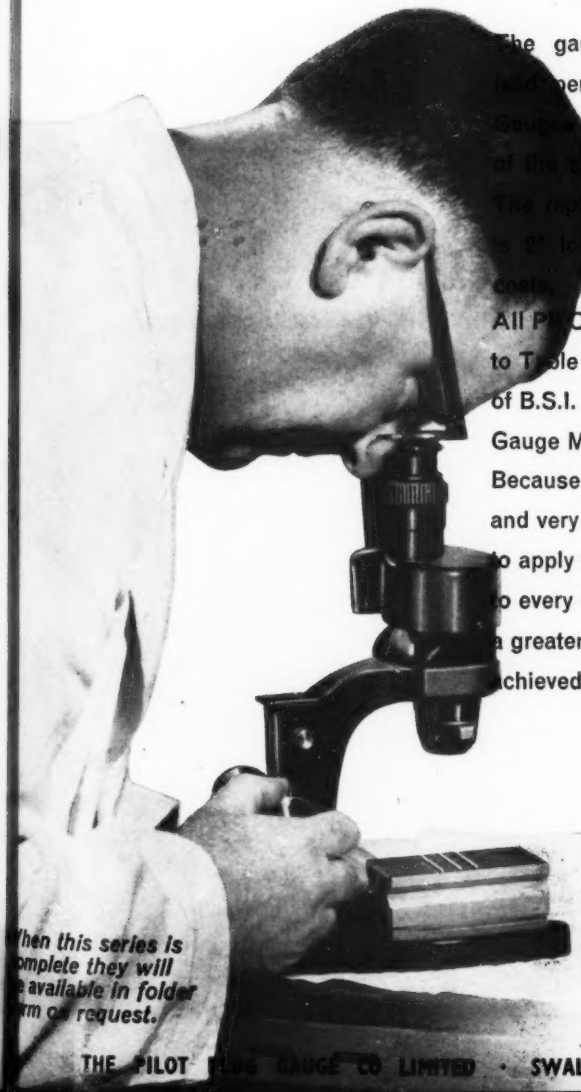

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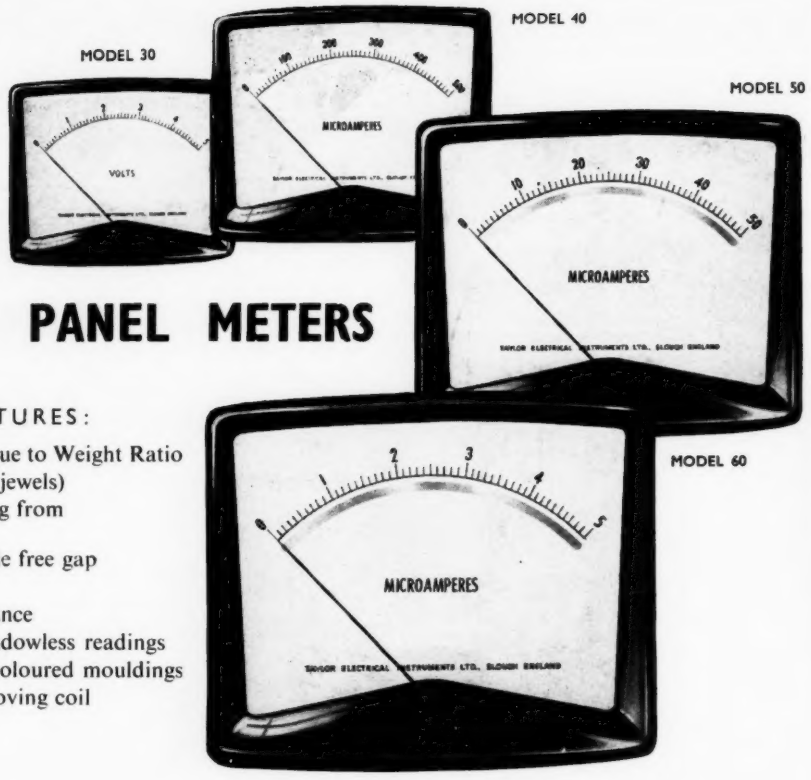

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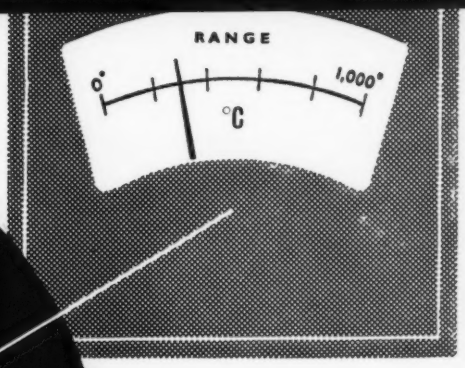

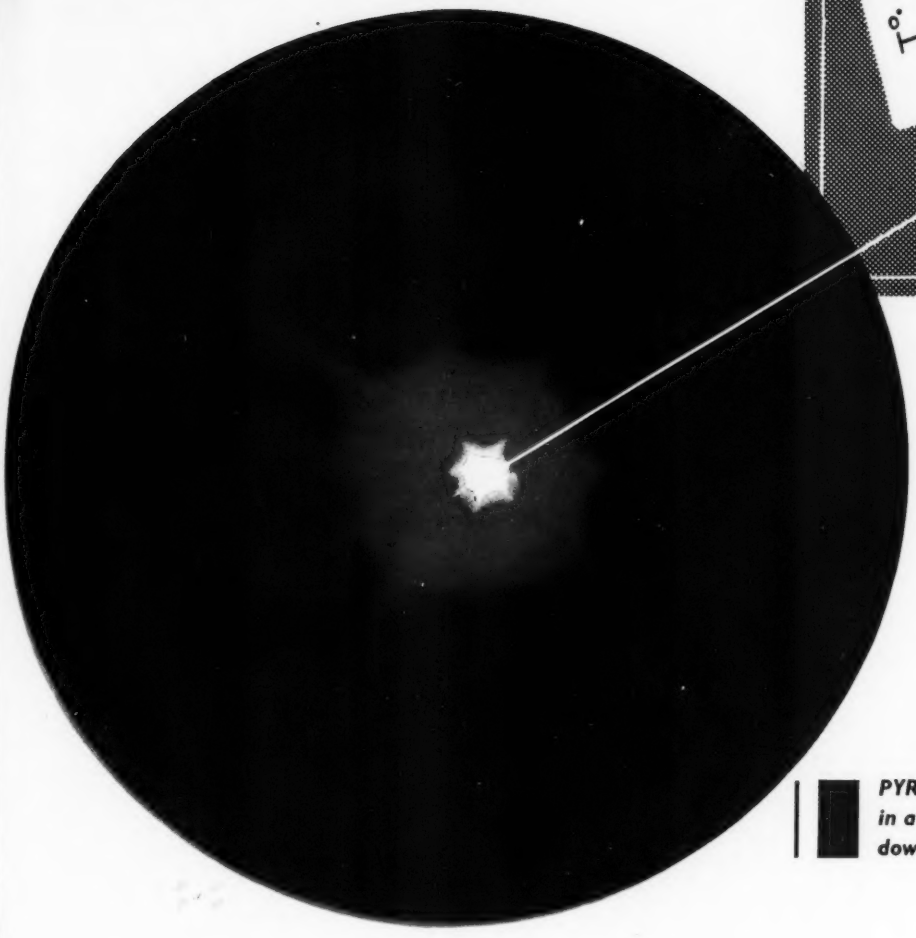

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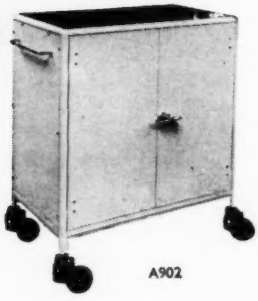
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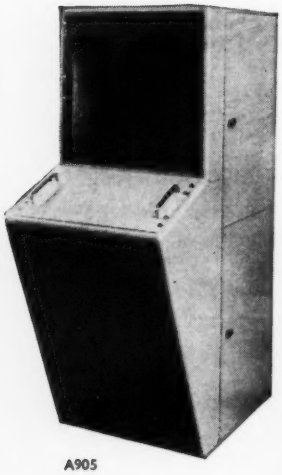
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Imlok is ideal for both your prototype and production work. It can be bought in 6 different stages of manufacture:— (1) individual corne. connectors with extrusions in 12 foot lengths; (2) connectors pre-drilled for assembly with self-tapping screws; (3) pre-drilled connectors with extrusions custom cut by Imhofs to your lengths and mitred; (4) framework assembled complete, ready for fitting your own panels; (5) complete structure with panels, but unpainted; (6) complete fully finished structure. Whichever way you buy Imlok you will reduce general costs, cut out tool costs and be certain of having exactly what you require—quickly

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The B.E. five-digit voltmeter can sample input voltages automatically at repetition rates up to 5 per second, or sample only on demand. It can also be used as a ratiometer, and in either mode it retains its long-term accuracy of better than 0.01% of full scale, for any of the five automatically selected ranges.

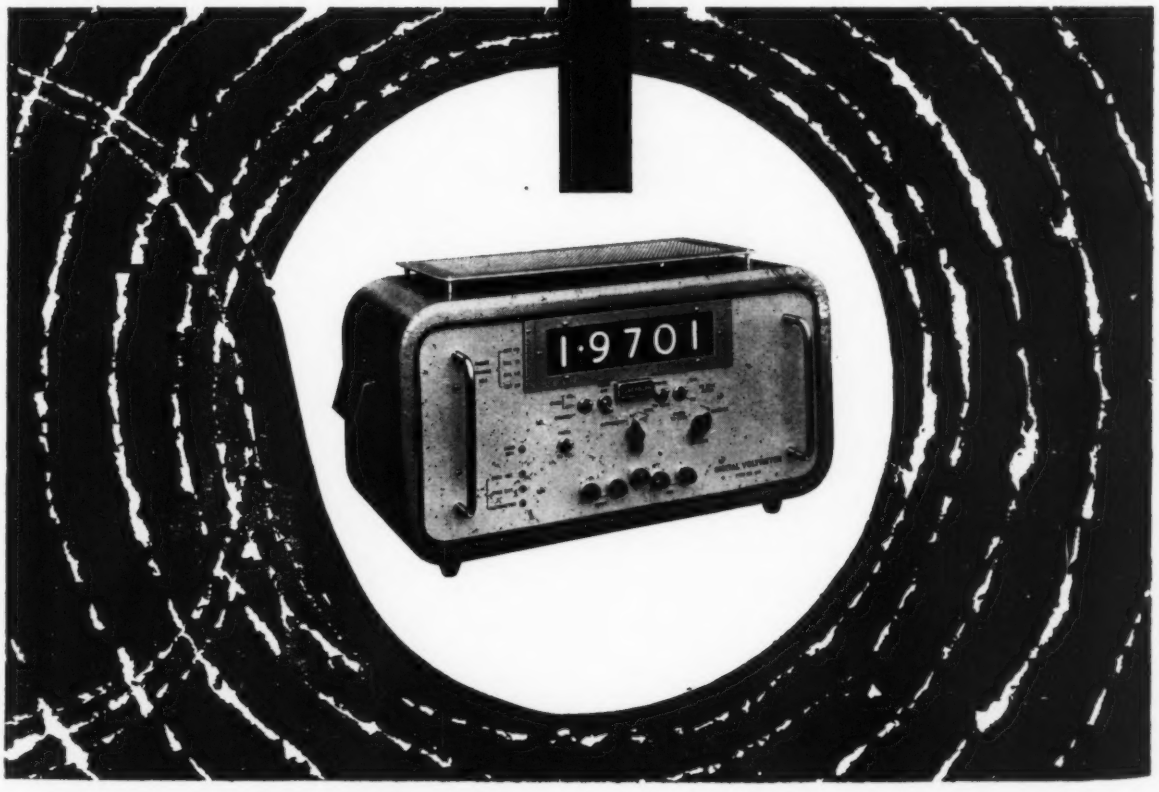
A parallel output is available for driving an in-line strip printer or other write-out equipment.

SPECIFICATION

Display	5 decimal digits projected in line, with decimal point
Polarity selection	Automatic, with red/black colour change
Accuracy	± 0.01% of full scale
Range	± 10 microvolts to ± 1000.0 volts in 5 ranges
Resolution	1 in 40,000
Conversion time	90 milliseconds maximum
Input impedance	20 megohms on all 5 ranges
Internal reference	2.038 volts from 2 Weston cells
External reference	20 volts D.C.
Power supplies	200/250 volts, 40 to 60 c.p.s. 0.9 amp.
Size	9″ x 19″ x 9″
Weight	30 lb. (approx.)

5-digit Transistorised Digital Voltmeter and Ratiometer

TYPE BIE 2116



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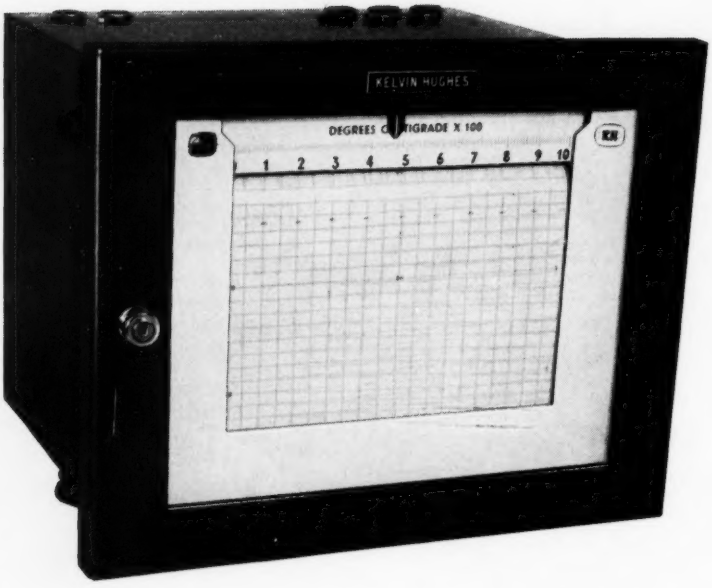

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★ Dead-beat Balancing: Brushless tacho-generator eliminates overshoot.

★ Accessibility.

★ Clear Chart Presentation: 8 in. long, 10½ in. wide chart exposed. Strip light optional.

★ Remote Indicators: Operated from basic instrument without adding secondary components.

★ Plug-in Range Changing.

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Available as single or multi-channel recorders for 2 to 12 input sources, these instruments offer many outstanding features, high accuracy and assured reliability at economic cost. Two-position or Three-position switching facilities for control or alarm operation can be added to the system.

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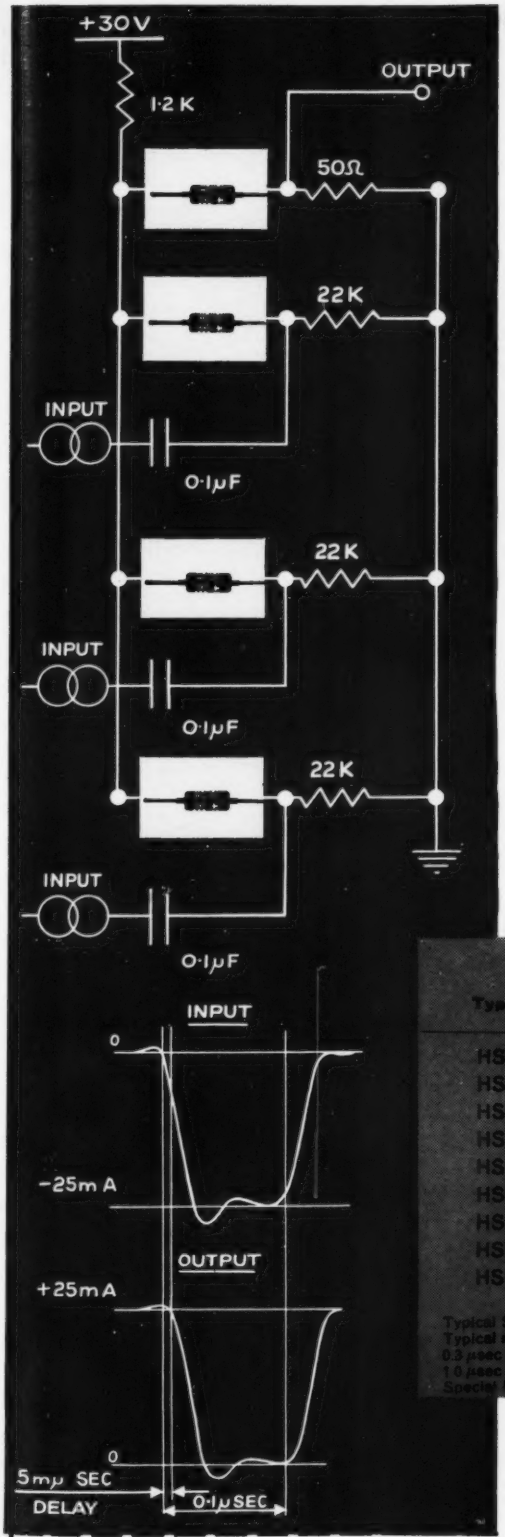

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Type No.	Continuous Ratings 25°C		Characteristics 25°C	
	Max. Rated P.I.V. (Volts)	Max. Forward Current	Min. Forward Current at 1.5V	Max. Reverse Current at P.I.V.
HS1101	150	80 mA	30 mA	1 μA
HS1102	100	80 mA	30 mA	1 μA
HS1103	50	80 mA	30 mA	1 μA
HS1104	150	60 mA	15 mA	1 μA
HS1105	100	60 mA	15 mA	1 μA
HS1106	50	60 mA	15 mA	1 μA
HS1107	150	40 mA	5 mA	1 μA
HS1108	100	40 mA	5 mA	1 μA
HS1109	50	40 mA	5 mA	1 μA

TEMPERATURE RANGE -65°C TO 150°C

Typical Stored Charge Measurement, 700 pico—coulombs.
Typical recovery time:
0.3 μsec measured in JAN256 circuit, to 80 K ohms when switched from I_F 5 mA to V_R —35 volts
1.0 μsec measured in IBM "Y" circuit to 400 K ohms when switched from I_F 30 mA to V_R —35 volts
Special Diodes from this range are available, featuring higher conductivity or faster recovery

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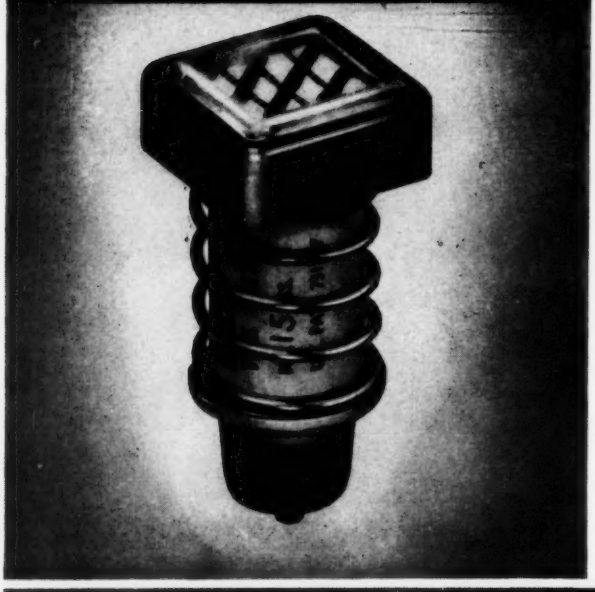
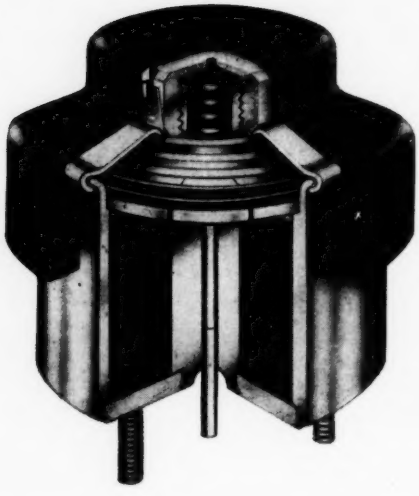
3-POSITION MAGNETIC INDICATOR
Maximum versatility of display, inherently reliable. Provides visual position indication for remotely controlled components.





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MODERN & COMPACT — Circular meter type case of only 6½" diameter. Direct reading scale 13" long.

EASILY FITTED — Simple clamp mounting. Can be mounted at any normal angle, for example, on an upright or sloping control panel. Robust terminals.

REALLY ROBUST. Sealed case houses printed electronic circuit; indicating pointer is driven by robust servo motor. Temperature sensing bulb is platinum resistance in stainless steel sheath tested to 2000 p.s.i.

TRANSISTORISED for exceptional reliability. Operates from 12 volt battery or normal mains supply.

REMOTE OPERATION. Indicator can be a few feet or 300 feet away from the temperature measuring point — no adjustments required.

73 TEMPERATURE RANGES available between -200° and +850°C with dials accurately calibrated in °C or °F. Temperature spans as short as 50°C or 100°F.

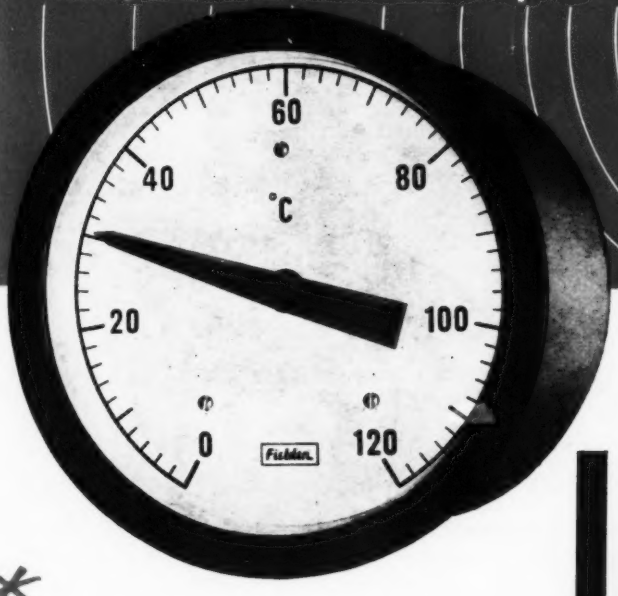
ACCURATE & RAPID RESPONSE. Reproduces to within 0.2°C on shorter temperature ranges to within 0.6°C on a 500°C span. Pointer will traverse whole range within 1 second.

LOW COST — electronic accuracy and stability at a fraction of its previous cost. Write for price list or telephone for quotation Wythenshawe (Manchester) 3251. Trafalgar (London) 3154, Walsall 28343, Stockton 68617 or Craiglockhart Edinburgh (A. R. Bolton & Co. Ltd.) 5235.

THE NEW LOW COST 'BIKINI' REG'D

TEMPERATURE INDICATOR

Temperature Indication up to 300 FEET



*

Temperature indication ***up to 300 ft*** from measuring point, using ***inexpensive electric cable.***

Calibration and speed of response unaffected by cable length.

Send for Specification Sheet BIK2/IP & Price List.

Fielden

FIELDEN ELECTRONICS LTD · WYTHENSHAWE · MANCHESTER
Phone: Wythenshawe 3251 (4lines) Grams: Humidity Manchester
ALSO AUSTRALIA, ITALY AND CANADA
Branch Offices: London, Walsall, Stockton-on-Tees, Edinburgh (A. R. Bolton & Co. Ltd) & Dublin.

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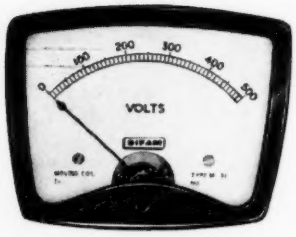
A·S·E·E
ELECTRICAL
ENGINEERS
EXHIBITION
EARLS COURT
MARCH 21st–25th
VISIT US ON
STAND Q. 13

To keep pace with the constantly increasing demand for one of this country's most comprehensive range of precision electrical measuring instruments, the new Sifam factory is now fully operative. Consolidating the resources of two previous plants, this new development, occupying 21,000 square feet, brings together under one roof machine shops, plastic moulding, tool rooms, plating, assembly and spray shops.

The new plant is purpose-built specifically for electrical measuring instrument development and manufacture. It is geared to ensure maintenance of high standards of service and product and special attention has been paid to new techniques in air-conditioning, dust-free assembly areas and internal communications.

a new factory... and a new range of instruments...



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Not illustrated, Type 61 with 5 in. scale.

Sifam
Instrumentation

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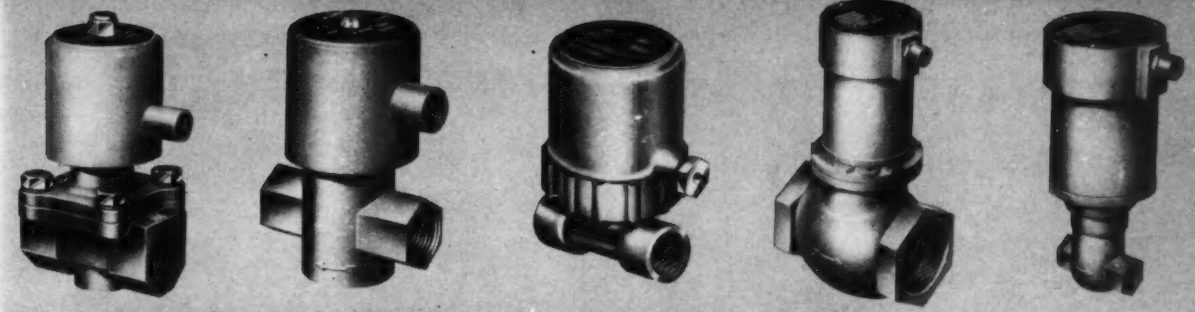
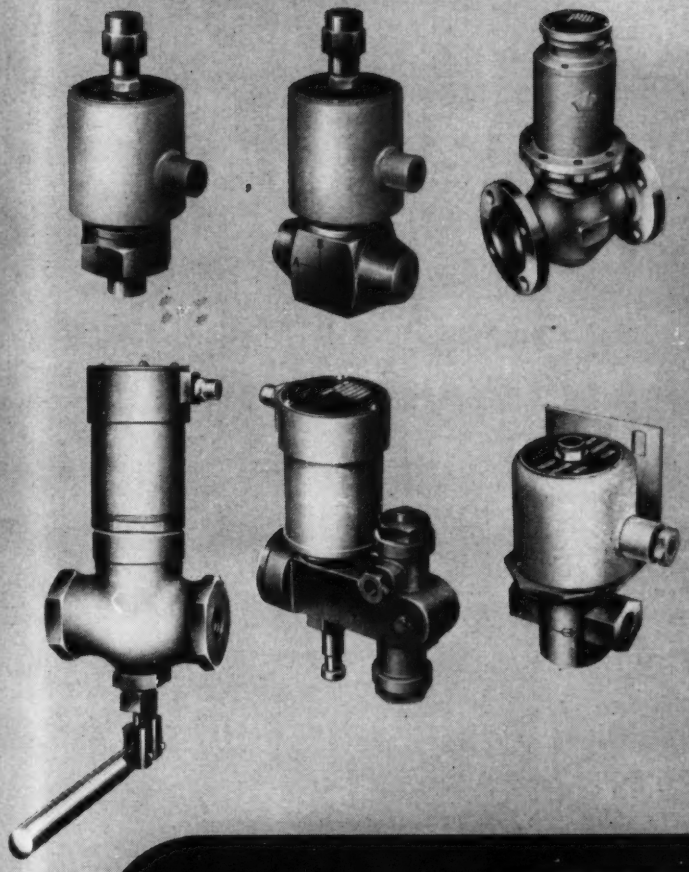


For any type of SOLENOID VALVE — whatever your need



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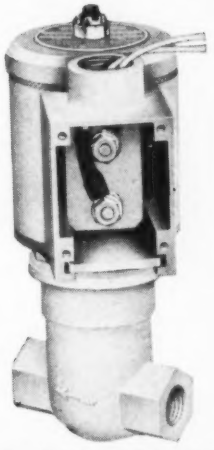
If the solenoid valves you require are not included in our comprehensive standard ranges, our Design Engineers will gladly develop special types to suit your requirements. Whatever your need, send us your enquiries for prompt attention.



Solenoid valve with special terminal housing, custom built to withstand severe vibration conditions and to permit direct connection to conduit.

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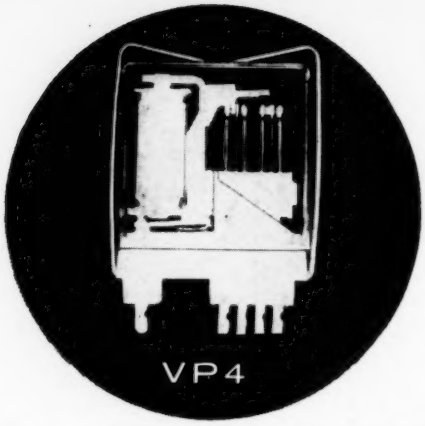
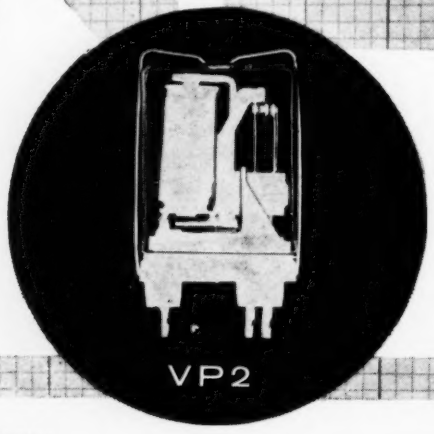


NEW!



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British made . . .

for long life

and perfect contact

Features:

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REGD. TRADE MARK

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British made

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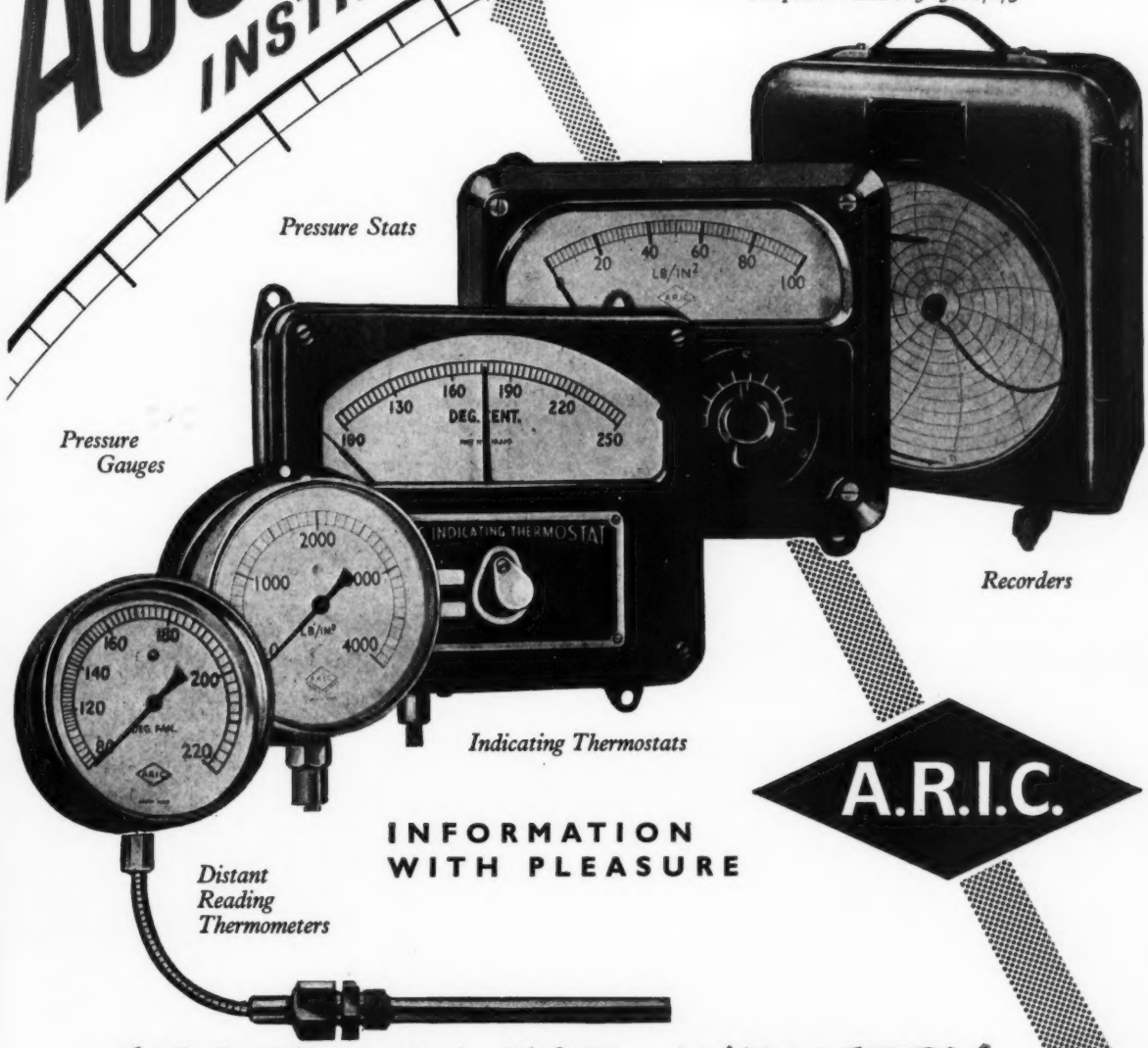

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VIBRATION

PEAK THRUST
5,300 lbs

TOTAL STROKE
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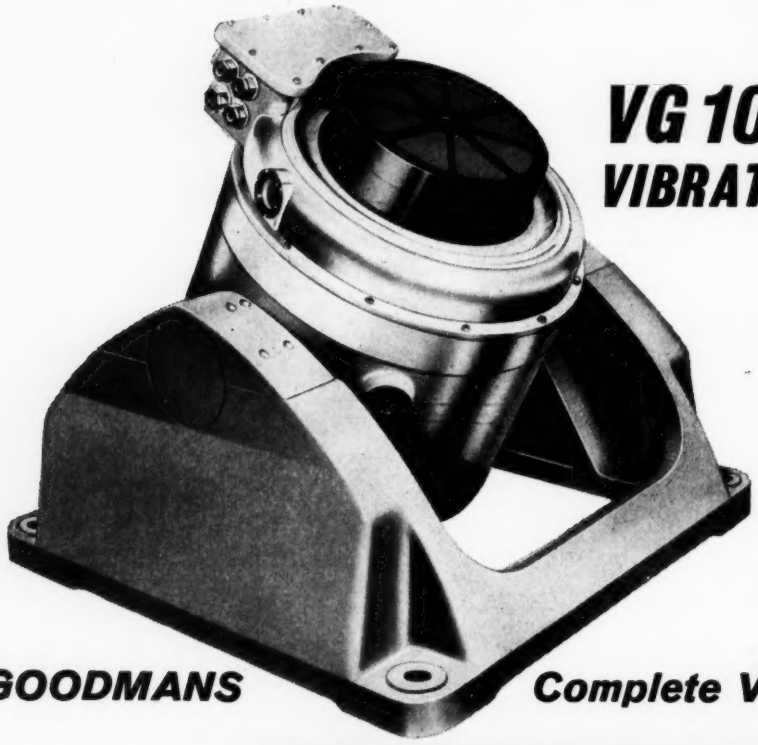

VG 108 MK11
VIBRATION GENERATOR

The VG. 108 MK II, available as a trunnion mounted Vibrator, presents a good compromise in a very broad field of Test requirements. Although this machine takes up a relatively small floor area, it retains sufficient weight to enable a high foundation mass to thrust ratio to be maintained. In performance the first structural resonance (unloaded condition) appears at approximately 2kc/s but under 'load' conditions subsequent damping enables the vibrator to be used to beyond 7kc/s. The full detailed specification is available on request.

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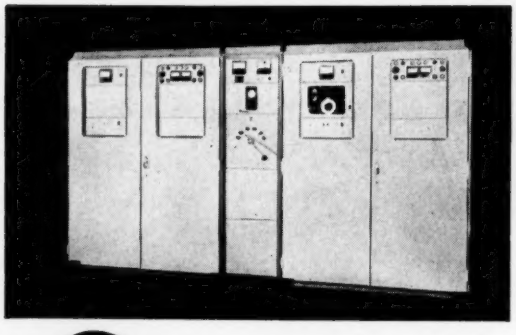

Illustrated left, is a PA 20KVA Power Amplifier; and above, the E501 'g' Control Amplifier.

*

Whatever the problem .. whether fatigue, torsional or structural investigation .. consult

GOODMANS *the vibration specialists*

GOODMANS INDUSTRIES LIMITED, AXIOM WORKS, WEMBLEY, MIDDLESEX, ENGLAND WEMBLEY 1200 (8 lines) Cables: Goodaxiom, Wembley, England

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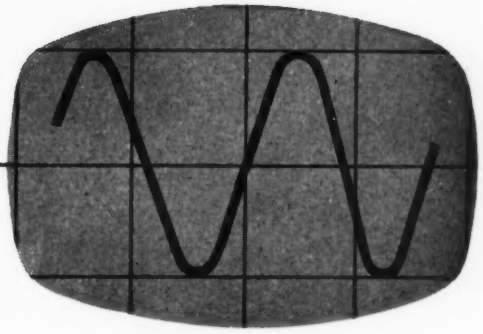

by Advance

the CVH RANGE

VOLSTAT

Advance constant voltage transformers are available in the CVH range with low harmonic distortion in the output waveform, ideal for use with precision equipment sensitive to power frequency harmonics, and also with all equipment requiring a constant voltage sinusoidal input.

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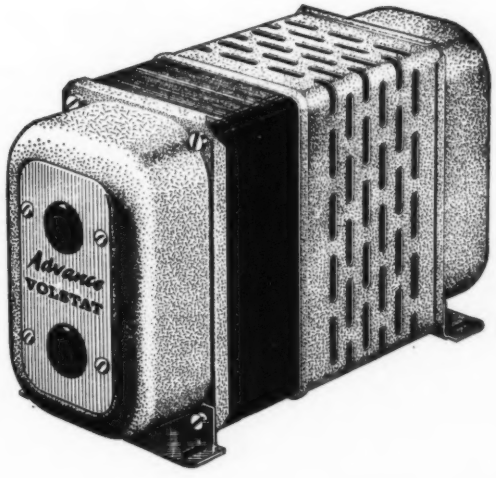
CVH60A	190-260 50 ~	240	60	1·00	£10 10 0
CVH125A	190-260 50 ~	230	125	1·00	£17 0 0
CVH420A	190-260 50 ~	230	420	1·00	£37 0 0
CVH750A	190-260 50 ~	230	750	1·00	£68 0 0
CVH1500A	190-260 50 ~	230	1500	1·00	£99 0 0
CVH3000A	190-260 50 ~	230	3000	1·00	£185 0 0
CVH6000A	190-260 50 ~	230	6000	1·00	£355 0 0



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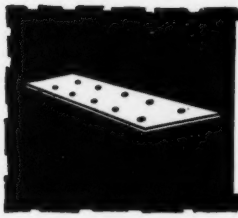
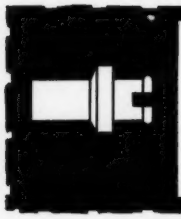
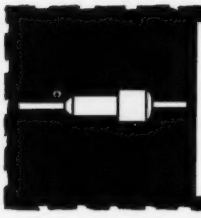


TERMINAL BOARDS



LUGS



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Harwin *make* components—*specialise* in components. Lugs, moulded insulators, terminal boards and chassis furnishings. 'Off-the-shelf' or to special design.
The *quality* of every Harwin component is the product of experienced, precision manufacture and rigid inspection—meeting, and in many cases surpassing standard specifications. In addition, Harwin *service* and *specialisation* in fulfilling individual needs is something to be experienced—talk over *your* component problems with Harwin and be sure of the *best* and most *effective* answer.

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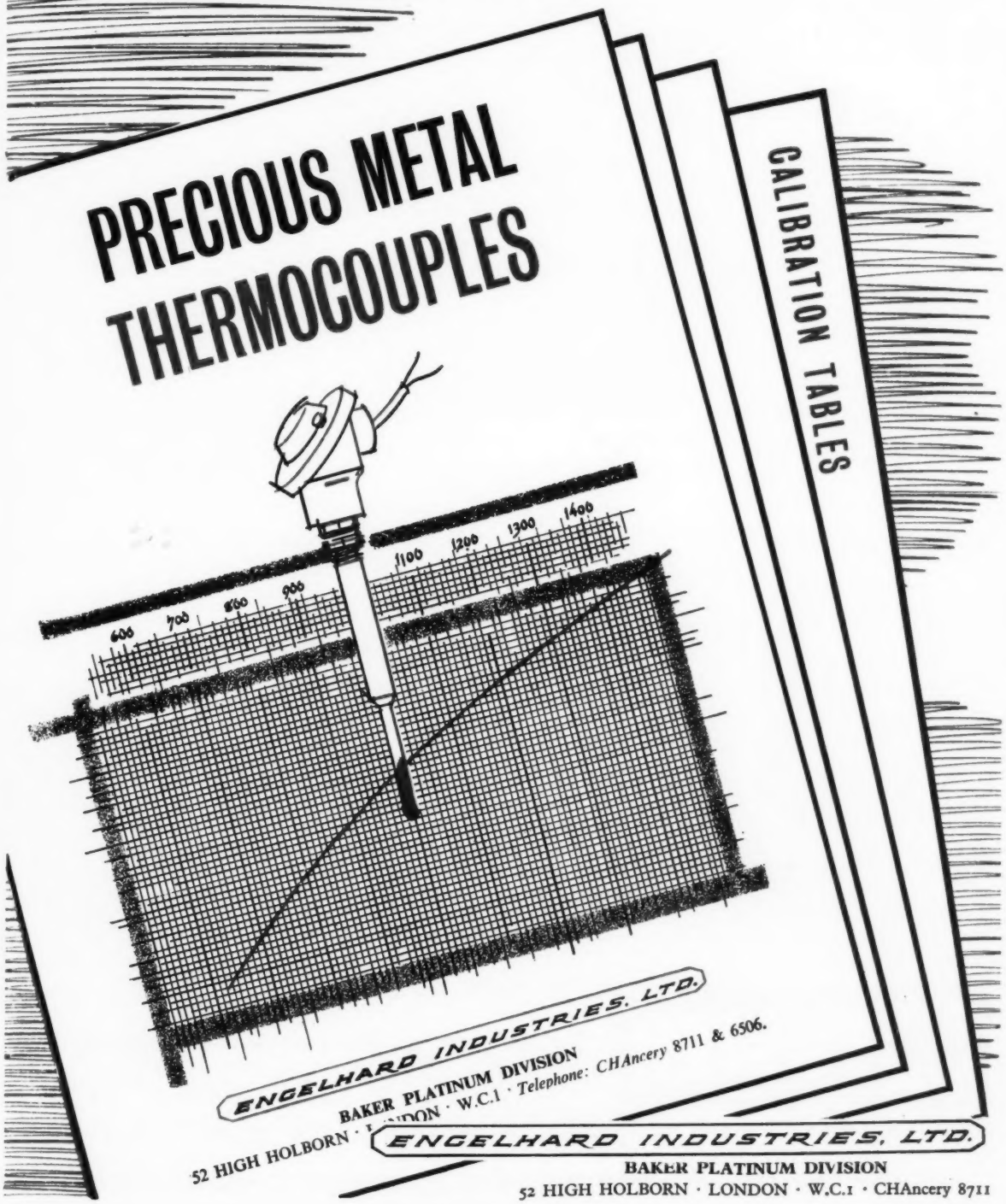
Write for this informative booklet

which gives details of the many thermocouple combinations available from Engelhard Industries together with graphs illustrating the temperature—e.m.f. relationship of each couple, and calibration tables for the most commonly used combinations.



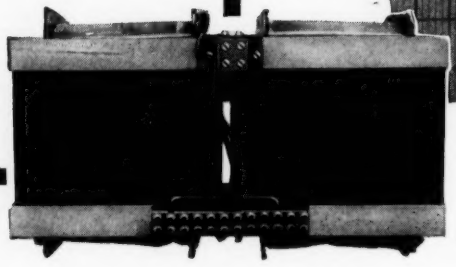
Circle 133 for further information

Saturable Reactor Control of Electric Furnace Temperature

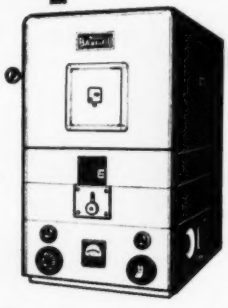
(3555/A86 Indicating Temperature Controller)

Indicator Controller Type 3555/A86

Magnetic Amplifier



Saturable Reactor



Electric Furnace (Illustrated by permission of Wild-Barfield Electric Furnaces Ltd., Watford.)

This controller incorporates a photoelectric system which provides a direct-current output proportional to the deviation of the pointer from the desired-temperature value. The current is amplified by a magnetic amplifier as necessary to give the full range of control of a saturable reactor, which is connected in series with the furnace. The system gives stepless control of the furnace voltage from 10%—90% of the supply value over the proportioning band, which is adjustable between 5%—10% of the temperature range.

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for temperature measurement and control

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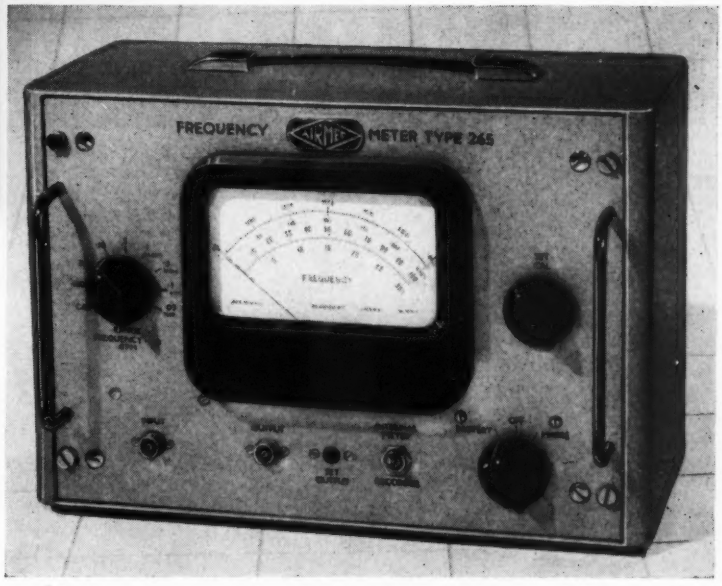
RIGHT
at every reading



- Take it — use it anywhere
- Transistor circuit
- Mains or battery
- Wide range
- Fine accuracy
- Suitable for tachometry

Special features

Completely portable and transistorised
Battery and Mains operated
10 c/s-100 kc/s in 8 ranges
Meter calibrated in frequency and r.p.m.
Input signal amplitude 0·075-30 volts r.m.s.
Output provided for operating a recorder
Special optical probe available for use as a tachometer
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FREQUENCY METER

(ELECTRONIC TACHOMETER) Type 265

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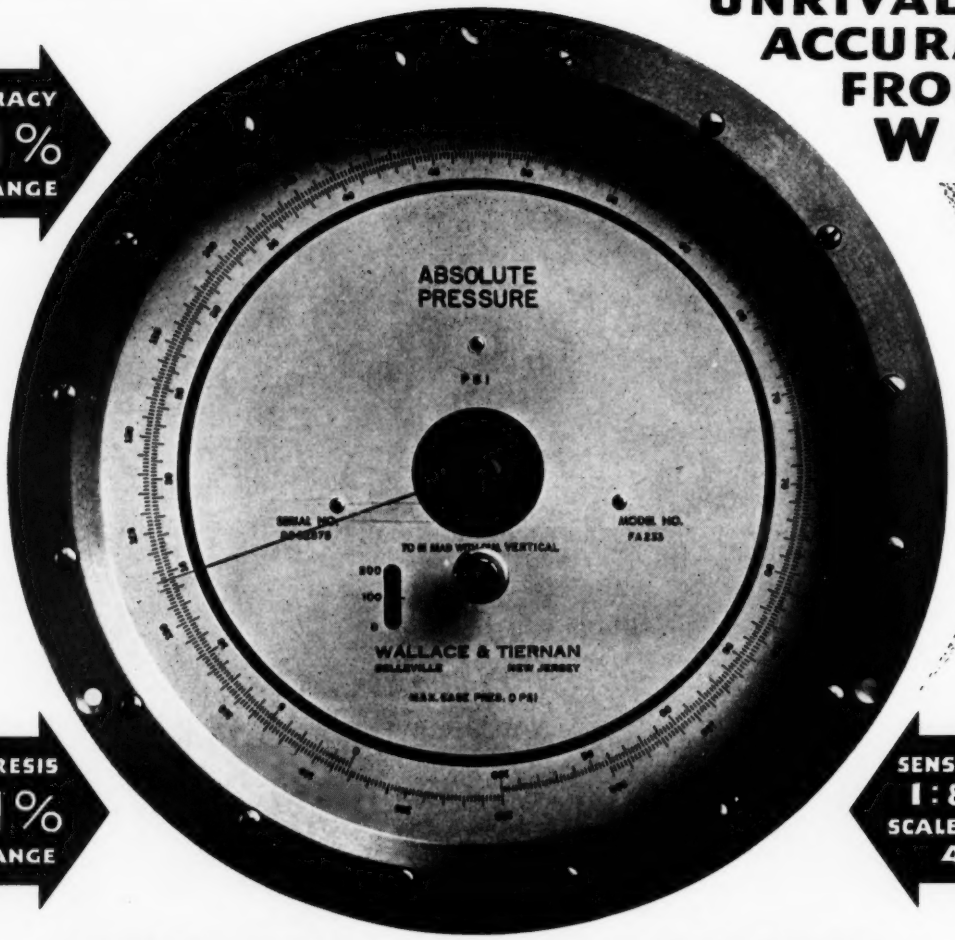
ACCURACY 0·1% OF RANGE



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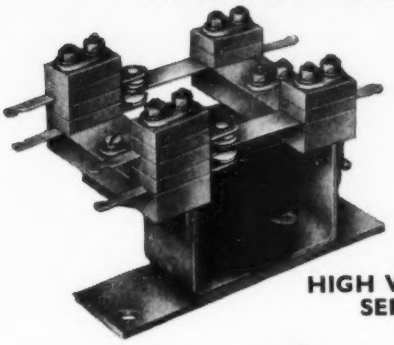

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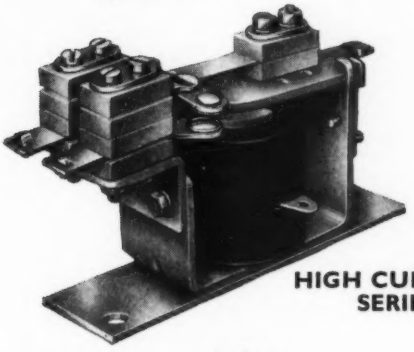

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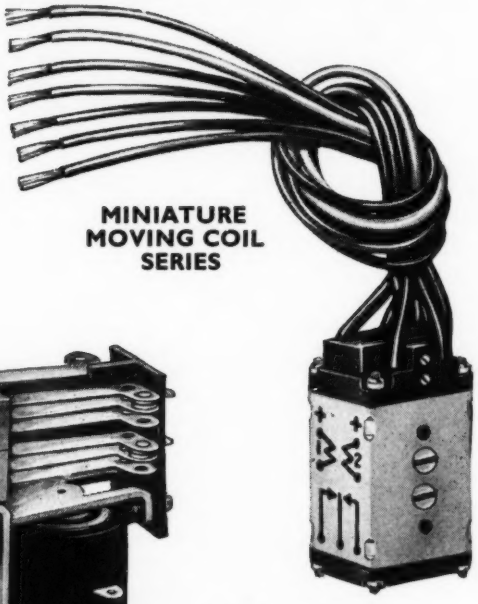

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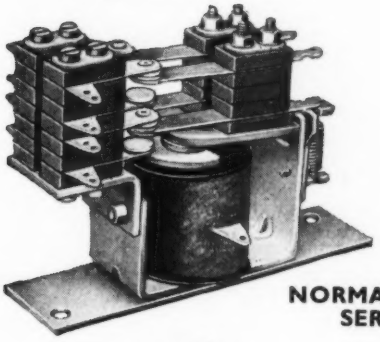

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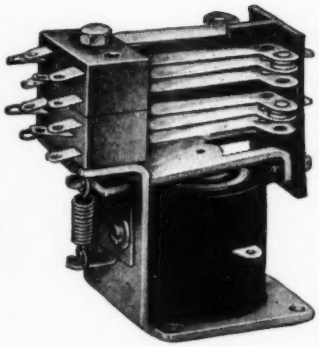

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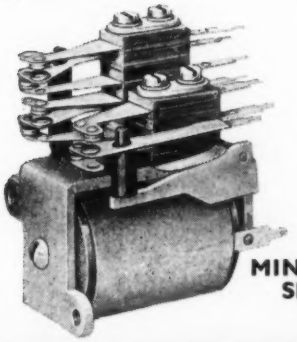

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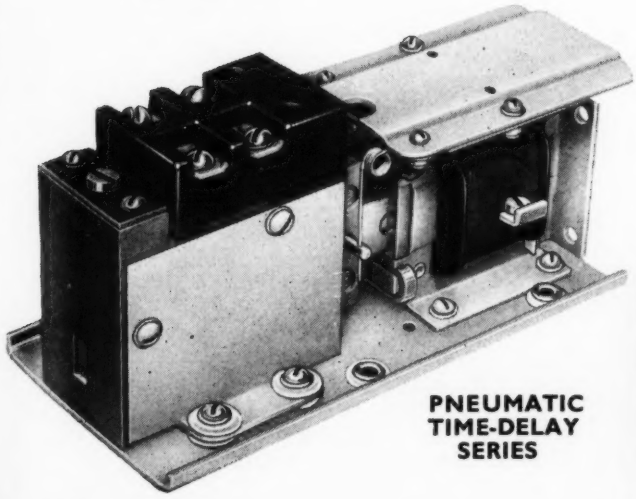

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Telephone: Stevenage 2110-7

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The instrument is suitable for use in hazardous areas and in extreme temperatures and it will operate data reduction or logging equipment. One remote indicator can be arranged to show the contents of up to 30 tanks in turn.

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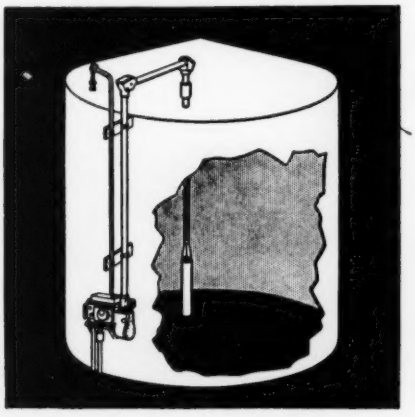
These gauges are available to American Class 1 Group D Division 1 classification. We are shortly producing them to meet Buxton flameproof requirements.

The range of Firth Cleveland Instruments includes Electrical, Mechanical and Hydrostatic Tank Gauges, Pressure Operated Switches, and Pressure Relief Valves. We shall be happy to send you full particulars.



Made under licence to Gilbert and Barker Mfg. Co., U.S.A. *For full details write to:*

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The RESISTRON

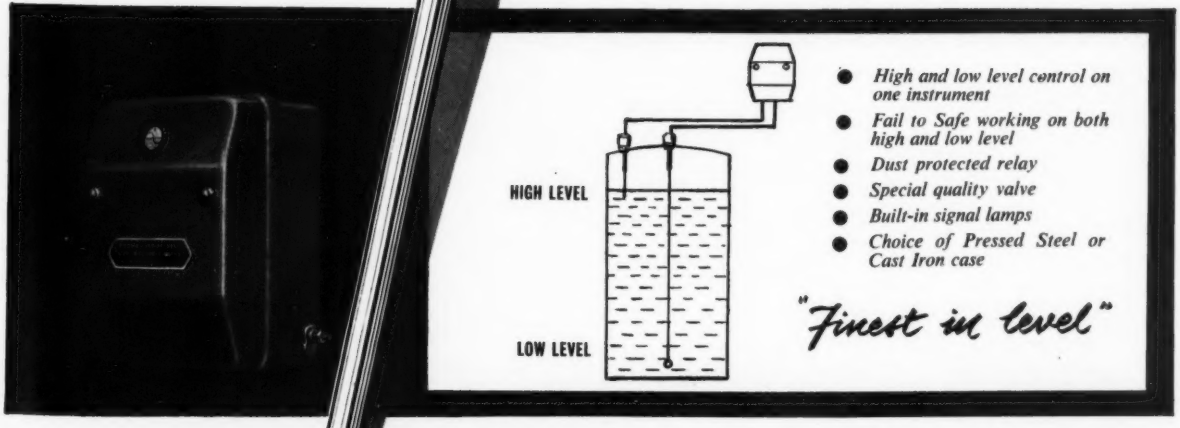
LOW COST

INDUSTRIAL
LIQUID LEVEL
CONTROLLER

This conductivity relay has been designed to fulfil the need for a low-priced industrial liquid level controller of exceptional reliability. The instrument does not involve any moving parts, in or on the container, and a full range of electrodes is available.

It can be used for the control of various types of acids, the level of water in feed tanks and one of its most important applications is on unattended boilers.

The Resistron is available in Multipoint versions and electrodes can be sited any distance from controller.



- *High and low level control on one instrument*
- *Fail to Safe working on both high and low level*
- *Dust protected relay*
- *Special quality valve*
- *Built-in signal lamps*
- *Choice of Pressed Steel or Cast Iron case*

"Finest in level"

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ALTRINCHAM · CHESHIRE. Telephone: ALTrincham 2321/2-2339 Grams: 'ELECTRONICS'
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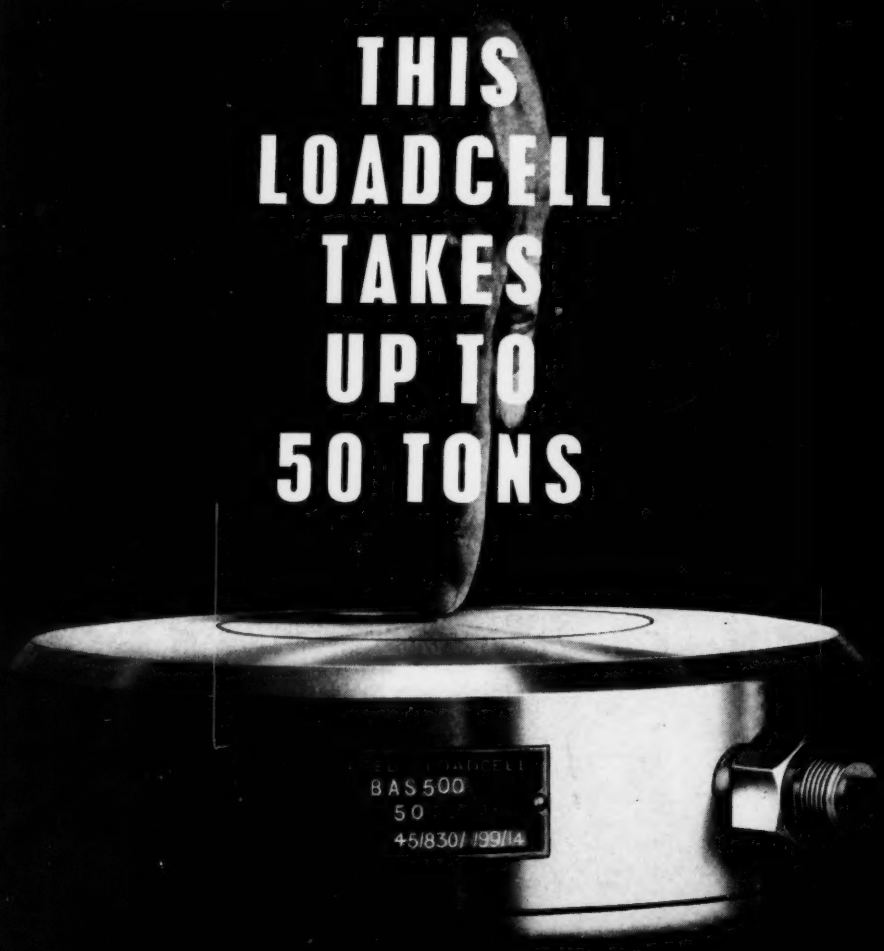
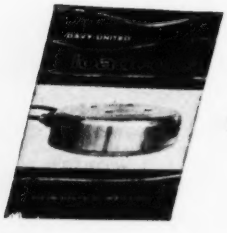
THIS LOADCELL TAKES UP TO 50 TONS



DAVY-UNITED LOADCELLS

FOR PROCESS CONTROL

Where materials are used in bulk, strain-gauge loadcell weighing is unrivalled for level and process control. Remote indication and recording facilities give flexibility to every application. Davy-United loadcells are engineer-designed for simple installation and tough service — yet give consistent high accuracies up to 0.1% of maximum capacity. Our engineers, specialising in this field, are ready to advise you on applying loadcells to your plant. Why not write or telephone for further information?



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DAVY-UNITED

DAVY-ASHMORE GROUP

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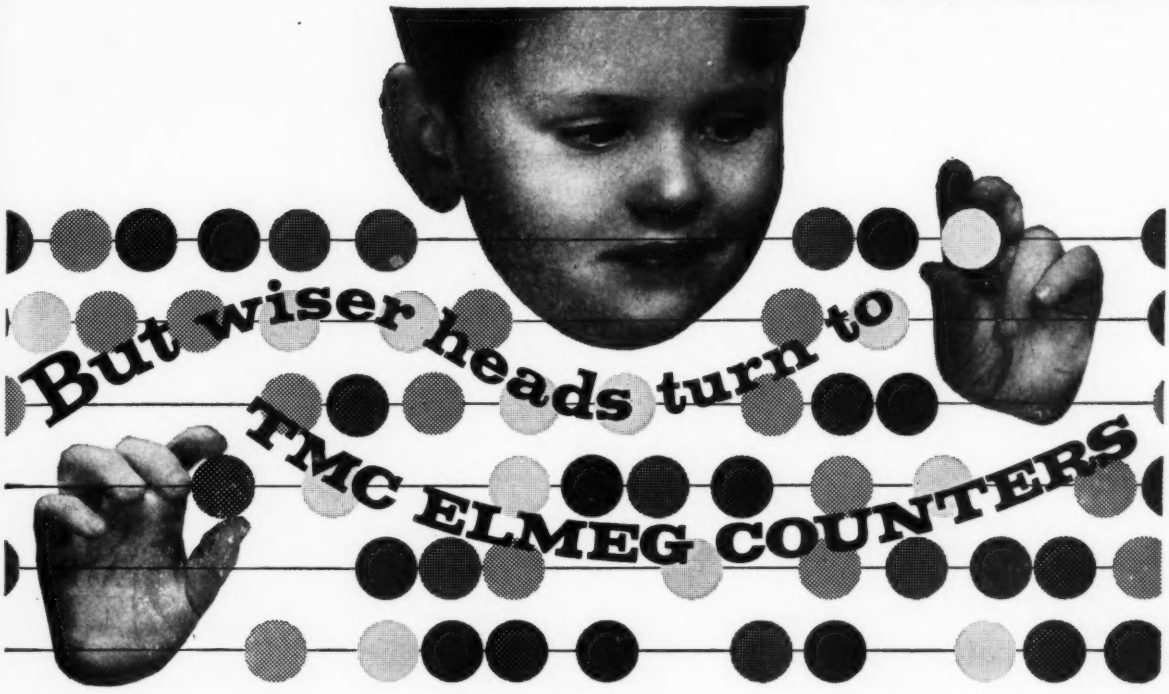


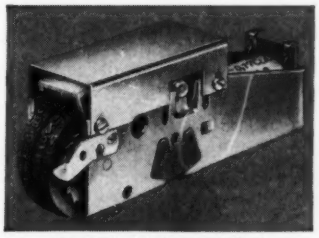
the new range with extensive applications and utmost reliability

including some counters of extreme compactness!

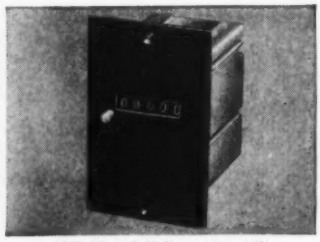
TMC Elmeg Counters are as near perfect as they can be made by the human skills of technical experts with years of experience and the most advanced equipment at their disposal. As a range, they are exceptionally versatile — offering a choice which should match up to even the most remote requirements. Available in "Print-Out" and "Read-Out" form, they have fast operating speeds of up to 40 per second. They operate on up to 220 Volts, with uni-directional or bi-directional motions. Re-setting to zero by electrical, mechanical or electro-mechanical methods. There are auxiliary contacts operating on each revolution of a numbered wheel. The range includes counters for flush panel mounting and surface mounting. No special servicing is required.

The number of applications for which TMC Elmeg Counters can be used to advantage are far too many to list in detail. The following will act as a general guide:

- *In conjunction with proximity switches or photocell equipment on production flow lines.*
- *In factory statistical equipment.*
- *In factory process control.*
- *In computers and office accounting machines.*



ZDmh—An 0-24 hours printout counter for vertical mounting



PZ5elR — 5-digit counter with electrical and mechanical reset.

You can register up to 9,999,999 on TMC Elmeg counters

TMC

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Relay Division E,

Telephone Manufacturing Company Limited

Hollingsworth Works, London, SE21. Telephone: GIPsy Hill 2211

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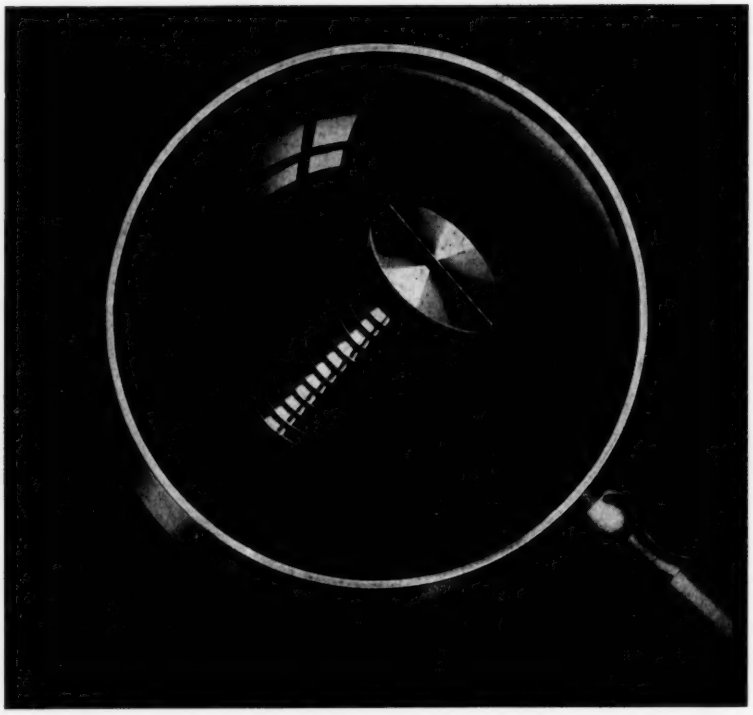

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AVAILABLE FROM STOCK

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protects flame-traps

from the dangers of blow-back flames

Circle 143 for further information

ETHER FLAME-TRAP ANCILLARY UNIT

Patent applied for
TYPE 350

This new safeguard, the ETHER Flame-Trap Ancillary Unit, Type 350, will be invaluable in industries where pre-aerated gas or pre-mixed gases are used. At present, a flame-trap is normally provided to arrest the flame temporarily when a blow-back occurs, but unless it is noticed, the flame will ultimately burn through the flame-trap.

Now this hazard need no longer exist. The ETHER Type 350 introduces a detector in front of the element of the flame-trap by means of which the supply of gas is shut off, or an alarm given, within a fraction of a second of a blow-back occurring.

The Type 350 is foolproof, compact and low in price. It can readily be adapted to fit all existing flame-traps. Illustrated technical data forwarded on request.

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ETHER (LIMITED)

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PERMANENT ATTRACTION

MAGLOY

Registered Trade Mark

cast permanent magnets

The outstanding qualities of MAGLOY materials enable the production of precision-cast magnets, even of small sizes, to relatively close tolerances. In addition, aluminium and synthetic jackets, for mounting purposes, provide a complete safeguard against magnetic damage.

High resistance to shock and vibration and to external magnetic influences, is further proof of the superiority of MAGLOY permanent magnets—produced at a plant capable of manufacturing a quarter of a million every week.

Remember, Preformations Limited offer a unique research-design facility to Design Engineers in the electronics industries. All the experience and services for the development of special designs to meet exacting needs are available.

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PM2

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any suitable counter becomes

- A Digital integrator for analogue type input signals
- A Digital Voltmeter
- An Analogue-to-digital converter

the RACAL SA503 is

- Available as a portable bench unit or as standard rack mounting units
- Fully transistorised

Price ex works £145 net

SPECIFICATION

Input:
Voltage ranges: 0·5V, 5V, 50V, 500V d.c.
Input impedances: On 0·5V range – nominally greater than 5MΩ. On other ranges – 20,000Ω per volt or higher with external attenuator.

Output:
Frequency: 0 – 5 kc/s (full scale).
Amplitude: 0 – 8V peak-to-peak square wave, continuously adjustable.
Impedance: 2kΩ (maximum).

Send now – *Publication 179D gives complete technical description and specification.*

RACAL INSTRUMENTS LIMITED

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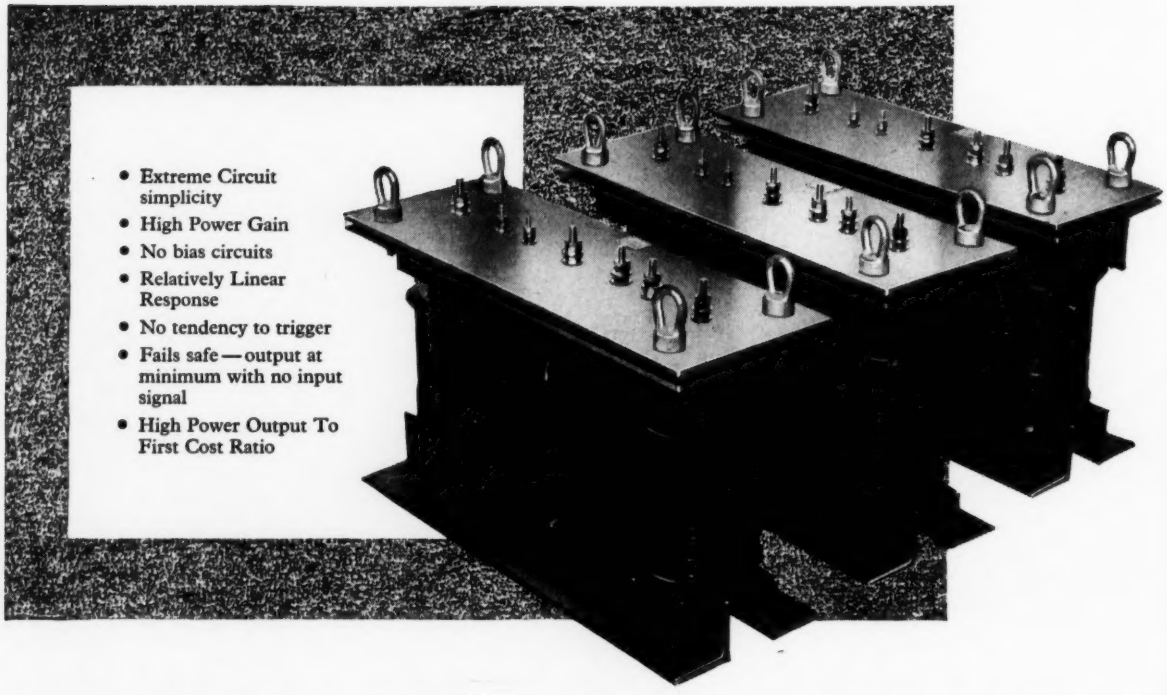
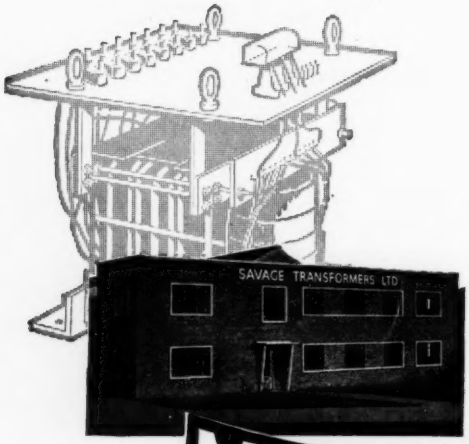
SAVAGE

Massicore transductors



- Extreme Circuit simplicity
- High Power Gain
- No bias circuits
- Relatively Linear Response
- No tendency to trigger
- Fails safe—output at minimum with no input signal
- High Power Output To First Cost Ratio

—the most economical and trouble-free method of Stepless Power Control



Illustrated are some of the new Savage Massicore Transductors for stepless power control. These provide the most economical and trouble-free method yet devised for controlling large blocks of electrical power for heating.

Available in a large range of sizes covering from one to fifty KVA—(one hundred and fifty KVA on three phase)—these components present a ready solution to many control problems.

There is also a "fail safe", no bias, magnetic pre-amplifier which functions on an input signal of 100 m/watts max.

If you have a control problem, however complicated or simple, write to

THE LITTLE FACTORY
WITH THE BIG REPUTATION

SAVAGE TRANSFORMERS LIMITED
NURSTEED ROAD, DEVIZES, WILTS

Tel: Devizes 932

SAVAGE MASSICORE

T.P. 74

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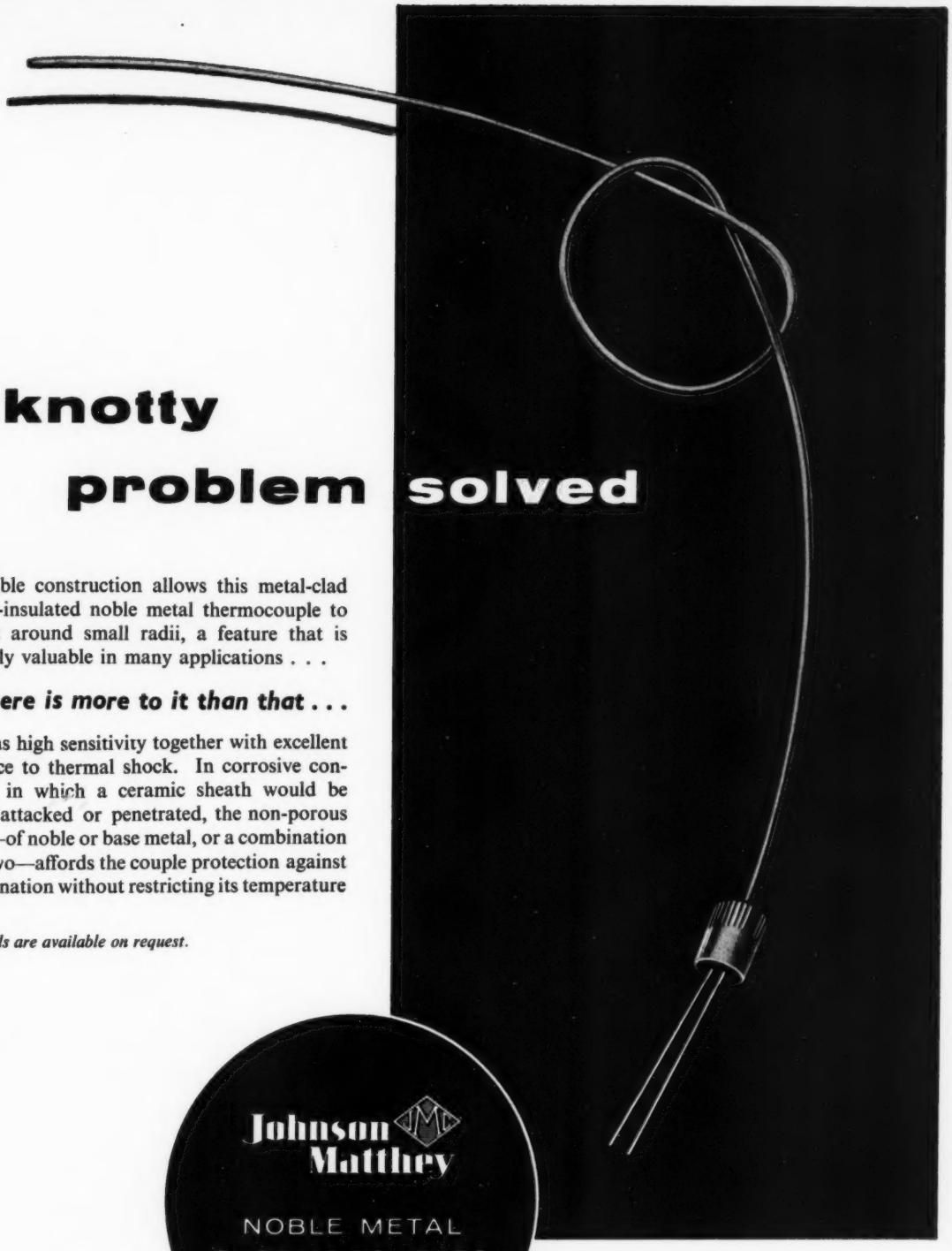

a knotty problem solved

Its flexible construction allows this metal-clad mineral-insulated noble metal thermocouple to be bent around small radii, a feature that is obviously valuable in many applications . . .

but there is more to it than that . . .

for it has high sensitivity together with excellent resistance to thermal shock. In corrosive conditions, in which a ceramic sheath would be rapidly attacked or penetrated, the non-porous sheath—of noble or base metal, or a combination of the two—affords the couple protection against contamination without restricting its temperature range.

Full details are available on request.

Johnson Matthey

NOBLE METAL THERMOCOUPLES

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Telephone: Holborn 6989

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75-79 Eyre Street, Sheffield, 1. Telephone: 29212

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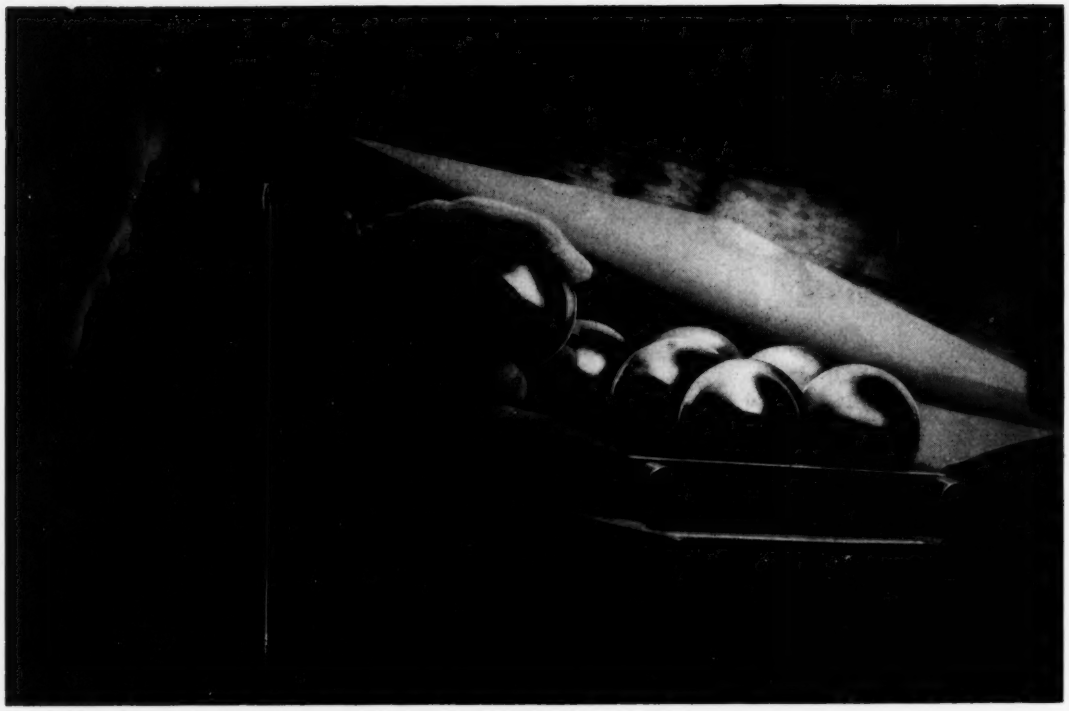


EYE ON THE BALLS

A striking picture no doubt—but only one out of a hundred that would tell a story of a stage in the manufacture of Hoffmann Bearings.

At this point in the story, it tells how human eyes are employed for the inspection of Hoffmann Steel Balls—the balls which later become the rolling elements of Hoffmann Ball Bearings. These eyes, extremely keen, highly trained, perceive the almost imperceptible, detecting cracks and blemishes of microscopic dimensions on the highly polished surfaces of the Steel Balls.

Hoffmann Bearings—masterly engineered—superbly finished are brought meticulously through every stage of production to make the final product which stands unsurpassed for high degree of accuracy and quality: behind every Hoffmann Bearing lies over 60 years experience.

HOFFMANN

HOFFMANN
BALL AND ROLLER BEARINGS

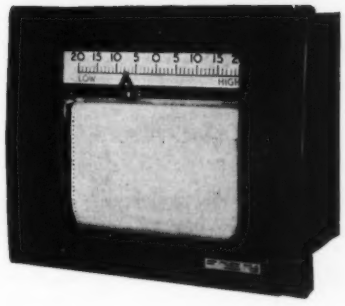
THE HOFFMANN MANUFACTURING CO. LTD., CHELMSFORD, ESSEX

TELEPHONE: CHELMSFORD 3151 TELEX NO. 1951

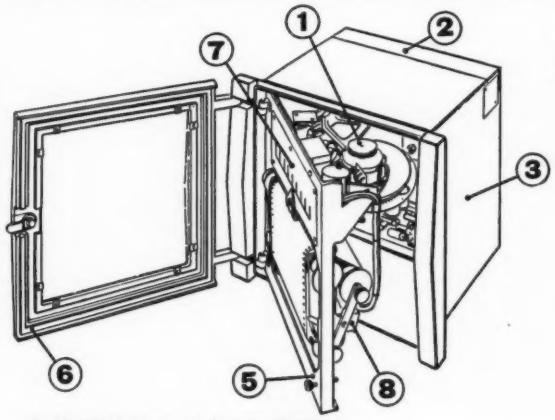
Circle 148 for further information

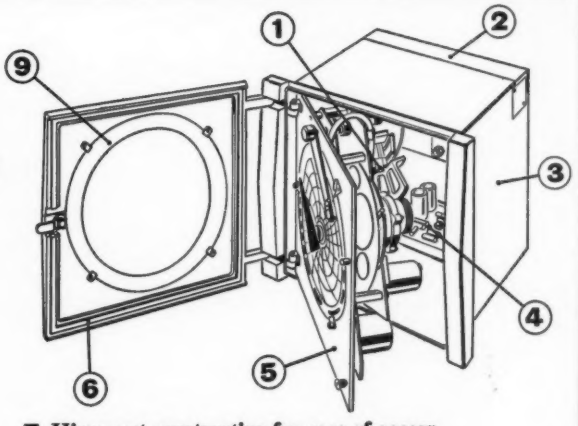
New servo rebalance indicator/recorders offer high performance at low cost

Available in 10″ circular chart and 10″ wide strip chart versions with 1 second full scale traverse and common mechanisms of simple rugged design providing a performance comparable with many more expensive instruments.



Both circular and strip chart versions are available with a wide range of measuring elements of all types–for temperature, pressure, flow, mechanical force, linear displacement. A special feature is the wide range of electrical measurements for which the instruments cater. A three-term control unit and associated electro-pneumatic valve positioner together with a comprehensive range of pneumatically operated valves are also offered in the form of completely integrated schemes.





1 Simplified pen drive mechanism
2 Ease of access for connections
3 Rugged steel case
4 Replaceable control units for required characteristics
5 Hinge-out construction for ease of access
6 Dust-sealed cover
7 Clear easy-to-read scale
8 Hinge forward paper feed mechanism
9 Large diameter indicator scale

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LIMITED

I.D.1. RUGELEY · STAFFORDSHIRE · ENGLAND Metal Industries Group

Manufacturers of the world's widest range of industrial electronic control equipment

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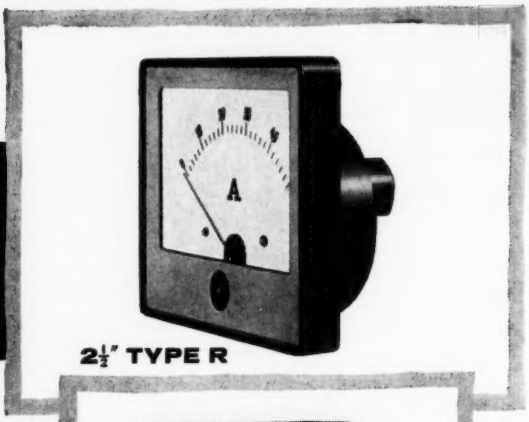
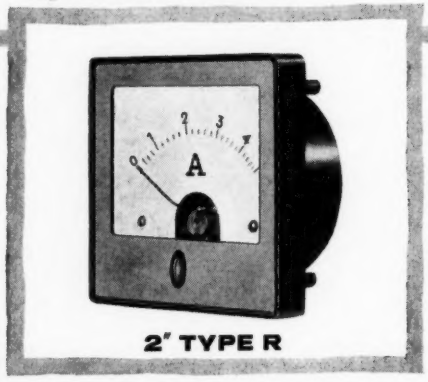
2"-2½" 3½" & 5"

new Type R

SALFORD

PANEL MOUNTING INSTRUMENTS





MOVING COIL TYPE

MOVING COIL WITH RECTIFIER

MOVING COIL WITH THERMO COUPLE

MOVING IRON TYPE

A unique feature of this new range is the front plate of anodised aluminium, supplied in any colour to match surrounding apparatus. The case, of clean rectangular styling is moulded in phenolic material, and fixing is easy and adaptable.

Instruments can be supplied for the measurement of all A.C. and D.C. currents and voltages.

The legibility of the scale is exceptional and all unnecessary markings have been eliminated. Scales are white enamelled on metal with black markings.

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SEI

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London Sales office: Magnet House, Kingsway, W.C.2. Tel: Temple Bar 4668

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TO MEASURE, RECORD OR CONTROL TEMPERATURES

accurately

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SIGMATIC INSPECTION

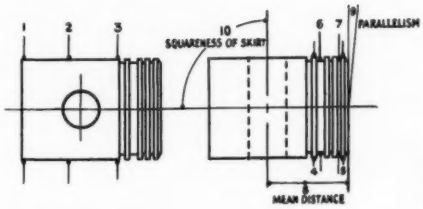
permits inspection at speeds comparable with their production

inspects internal and external diameters and lengths, thickness, radii, tapers, threads, concentricity, squareness, wobble, straightness, profile, relationship and ovality . . . singly or in any combination up to sixty dimensions simultaneously. Component stationary or revolving; both conditions on two-stage machine.

Operated by unskilled labour.

Appropriate components segregated according to size.

For continuous or small batch production and inter-operational or final inspection.



2"- 4" PISTONS

14 Dimensions inspected at up to 500 per hr.

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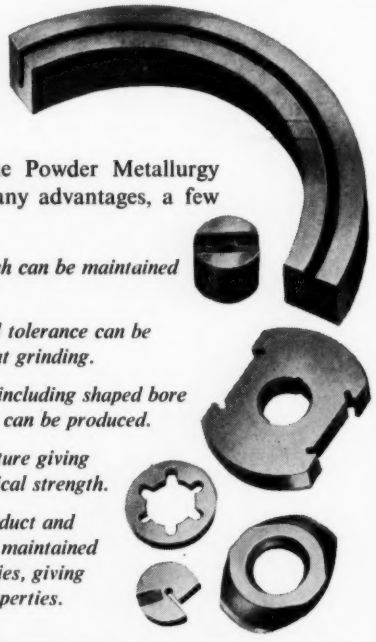
The extensive range of modern permanent magnet alloys has been developed to meet the increasing demands of industry.

Murex Limited specialise in the production of permanent magnets by the powder metallurgy technique. These magnet alloys can be divided into two categories, isotropic and anisotropic. Isotropic alloys show equal magnetic properties in all directions and anisotropic alloys exhibit enhanced properties along certain pre-determined paths.

Permanent magnet alloys currently manufactured by Murex are :—

ALNICO isotropic	Br 7,000	Hc 550	BHmax 1.5
ALCOMAX III anisotropic	Br 11,000	Hc 620	BHmax 4.1
ALCOMAX IV anisotropic	Br 9,500	Hc 725	BHmax 3.5
HYCOMAX anisotropic	Br 8,100	Hc 810	BHmax 2.6
COMALLOY isotropic	Br 10,000	Hc 250	BHmax 1.0



Manufacture by the Powder Metallurgy technique offers many advantages, a few of which are :—

- *Good surface finish can be maintained without grinding.*
- *Close dimensional tolerance can be maintained without grinding.*
- *Complex shapes, including shaped bore and counterbores, can be produced.*
- *Fine crystal structure giving increased mechanical strength.*
- *Uniformity of product and alloy composition maintained over large quantities, giving consistency of properties.*

More detailed information on these materials, together with design data and a list of standard shapes and sizes currently available can be provided on request. Technical Personnel are available to advise customers upon the use and application of these materials.

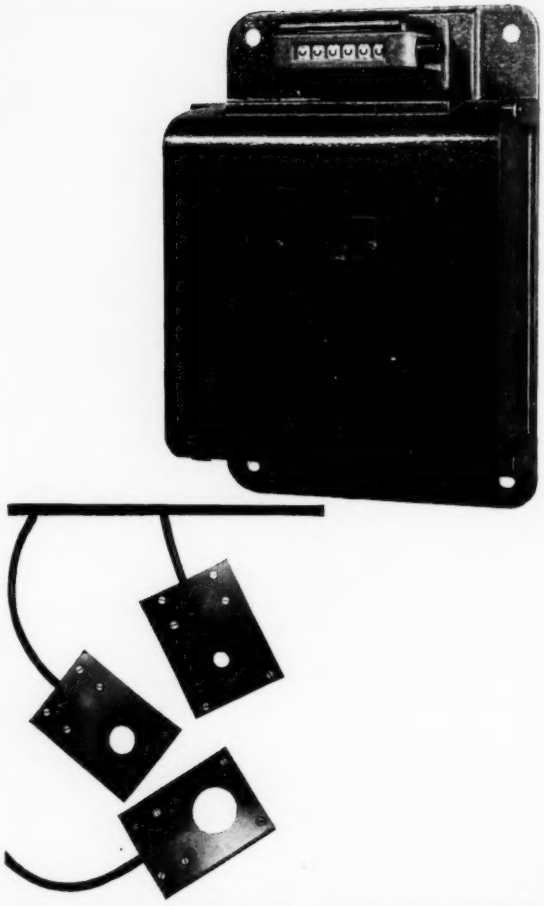
MUREX LIMITED

(Powder Metallurgy Division)

Rainham, Essex *Rainham, Essex 3322*

Telex 28632 Telegrams : Murex, Rainham-Dagenham Telex.

London Sales Office : Central House, Upper Woburn Place, W.C.1 *Tel. EUSton 8265*



ELECTRONIC COUNTER

The Type EE98 Electronic Counter is a general purpose unit designed to count products which are partially or entirely metallic. Small objects are dropped through the hole in the pick-up coil the smallest convenient hole being used. Larger objects are passed as close as possible to the aperture. Up to 400 objects per minute can be counted and four standard interchangeable coil units are available with ½″, 1″, 1½″ and 2″ diameter apertures. This instrument can also be supplied without the electro-magnetic counter and used for the control of machinery etc.

TELEDICTOR LIMITED

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Manufacturers of encapsulated coils, all types of iron-cored transformers up to 20 KVA (air cooled), solenoids, loudspeakers and specialised electronic equipment.

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FOR GAS, AIR, OIL AND LIQUIDS

MINIATURE GAS PILOT VALVE
Size ¼" B.S.P
For use on gas/air.

FUEL OIL VALVE—
air operated
Size ⅛"—¼" B.S.P

CONSTANT FLOW VALVE
for controlling flow of fuel fed by ring main systems.

OVERHEAD HEATER VALVE
Size ⅛"—¼" B.S.P

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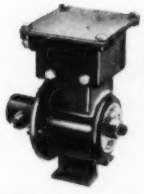

3-WAY AIR VALVE
ADMIRALTY pattern otherwise as TW/HP/AC.
Size ⅛", ¼", ⅜" B S P

3-WAY VALVE diaphragm operated suitable for use on hydrogen at pressures up to 22,000 p.s.i.
Size ⅛", ¼", ⅜" B.S.P

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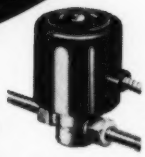
AUTOMATIC CONTROLS LTD

DIFFERENTIAL PRESSURE SWITCH
Pressure 300 p.s.i.
Temperature 250°C



FUEL OIL VALVE
Size ⅛"—¼" B.S.P
Pressures up to 500 p.s.i.g.

FLOW SWITCH
Standard model size
⅛" B.S.P —¾" B.S.P
Other models in sizes up to 14"

FUEL OIL VALVE
Size ⅛"—¼" B.S.P High pressure, high viscosity

The range of solenoid and diaphragm operated valves and pressure switches developed by Black Automatic Controls is finding a rapidly increasing acceptance in modern industry, including the missile and nuclear energy fields.
Whatever your application, whatever the medium or operating temperatures, if it can be made Blacks can make it. Let us know your problems. Purpose made or standard we could well be of assistance to you. Send us full details of your applications and we can put forward suitable recommendations.

SEND US YOUR ENQUIRIES

Black Automatic Controls Ltd
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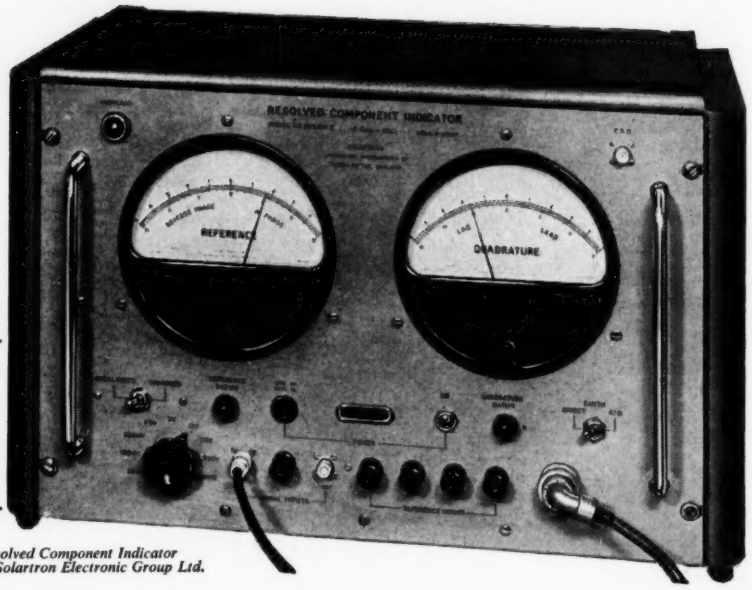

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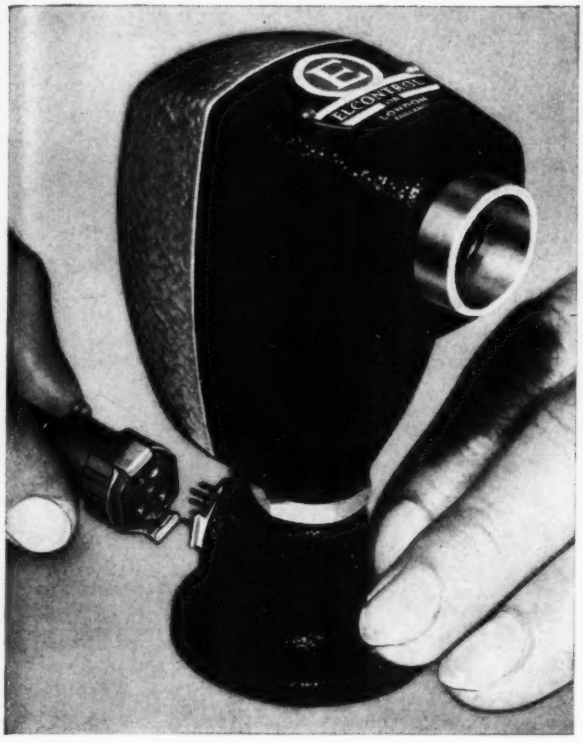

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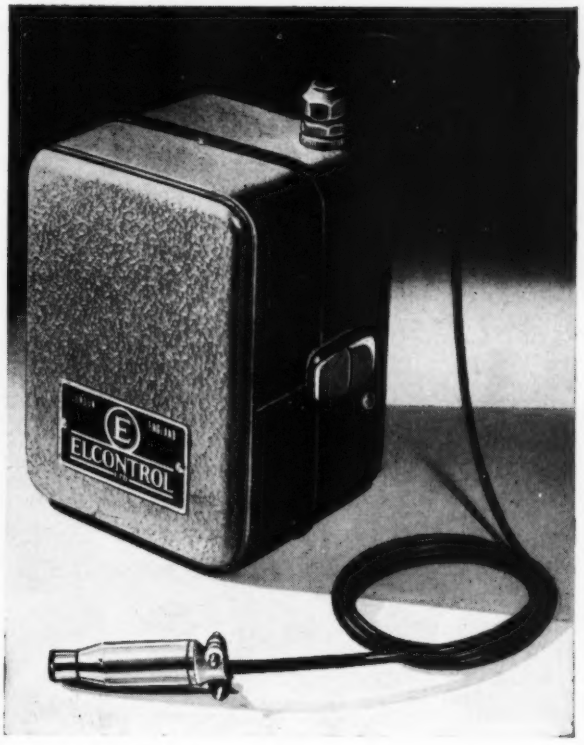

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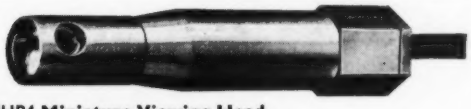

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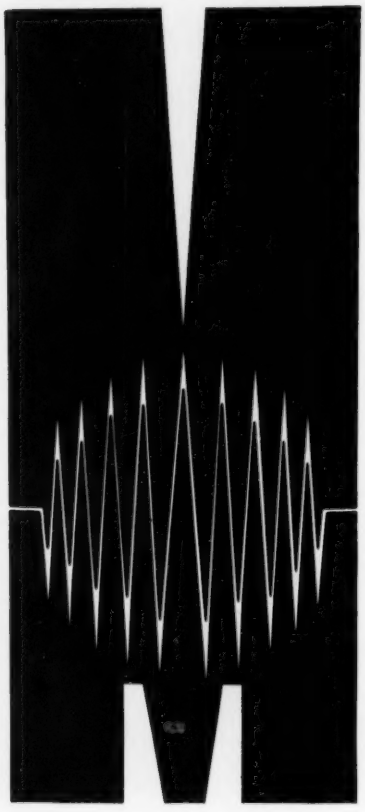

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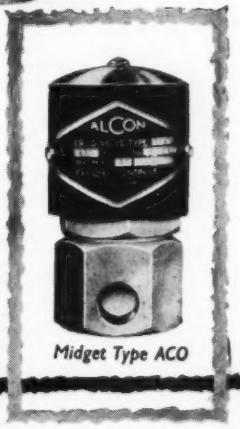

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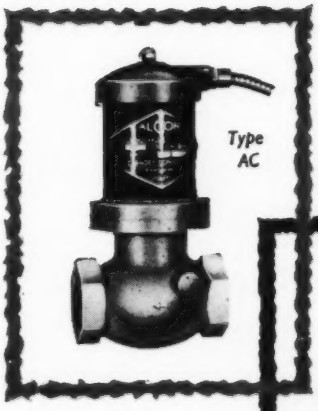

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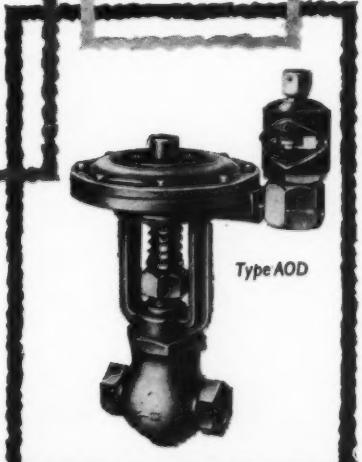

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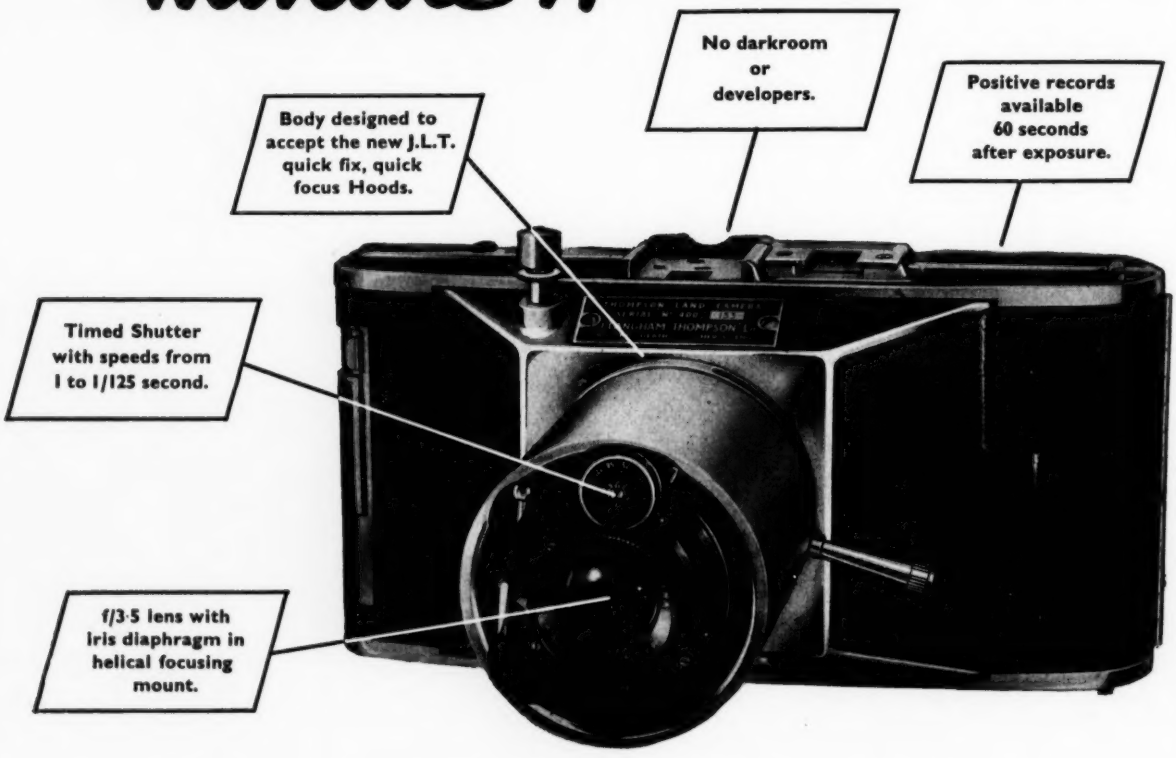
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CONTROL SYSTEMS-ELECTRONICS-AUTOMATION

Editor: J. T. Miller, B.Sc., F.Inst.P.

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VOL. 15. No. 3

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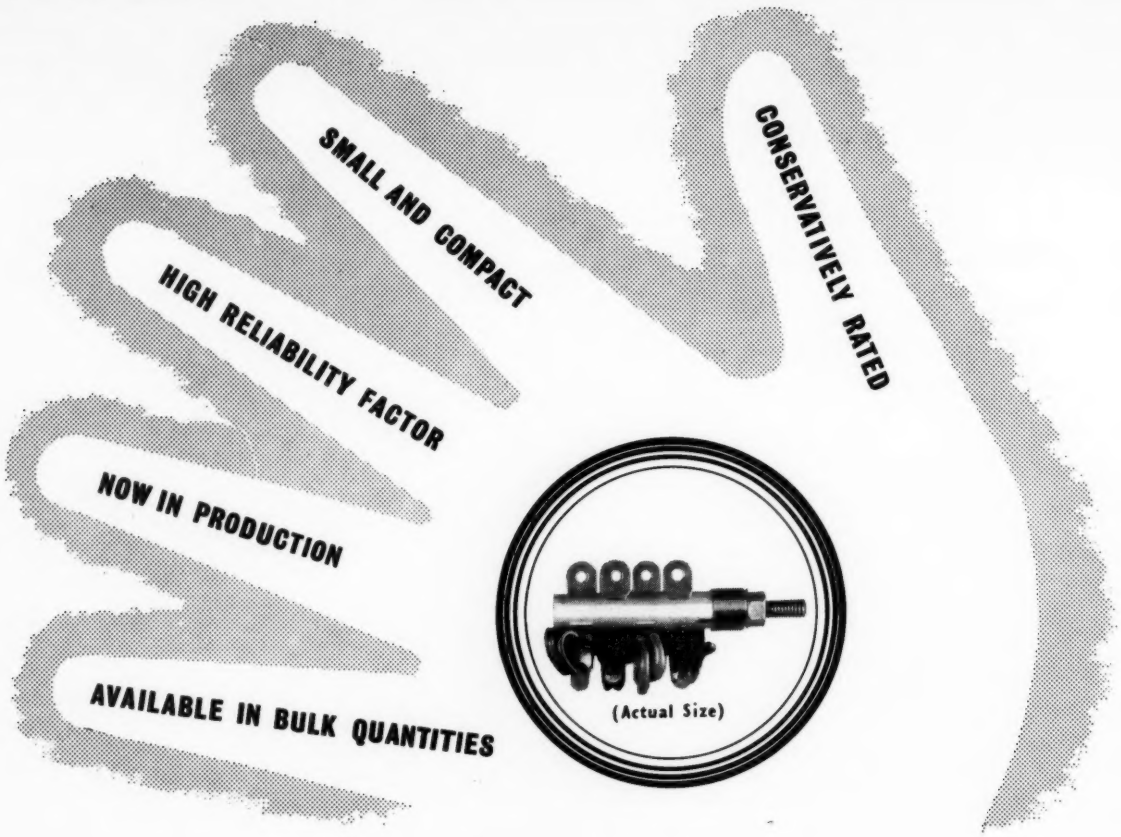

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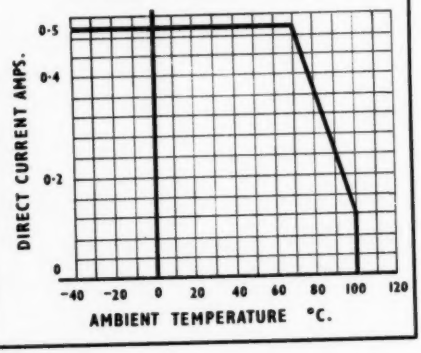

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INSTRUMENT PRACTICE

COMMENTARY

Infra-red A recent communication from the National Bureau of Standards draws attention, generally, to a serious lack of standards and calibration methods for ranges of physical conditions occurring in the newer techniques—in particular those associated with space missiles. One need, it mentions, is for a "standard wet atmosphere" as a basis for evaluating the performance of infra-red systems. This serves to remind us that instrumentation based on the use of infra-red wavelengths has been unobtrusively increasing until it has formed a significant field of its own.

Certain recent international incidents have given prominence to aerial reconnaissance methods, of which the infra-red variety has received its due share. Whilst the infra-red method possesses some disadvantages in that it is less sensitive than radar, suffers greater attenuation than radar and supplies no range information, a system based on the passive reception of infra-red radiation from the area to be surveyed has the great advantage that it can be undetected. Information processing rate, in addition, is not dependent on pulse transmission-reflection time. A typical method could involve a prismatic mirror with a number of sides, rotated by an electric motor, acting as a scanning device. The radiation reflected from the scanning mirror may be received by an infra-red detecting system producing electrical output signals. The latter may then be amplified and used for display and photographic purposes.

Recently, the production of infra-red and optical masers has been announced. Atoms excited by a radiation of given frequency can lose energy by emitting a quantum of the same frequency as the exciting one. But, if a radiation of given frequency is incident it can force the excited atom to emit radiation of the same frequency and return to the lower energy state. If the emitted radiation is in phase with that of the incident radiation a stimulated system is obtained. The method involves a state in which the number of excited atoms present must be greater than the unexcited ones. It can be seen that if the stimulation action is repeated a number of times it can considerably augment the original excitation. So far, the masers produced have been mainly research items but in the main have consisted of rods of material, such as ruby, whose flat ends are silvered. The exciting radiation is admitted through the side and a narrow beam of stimulated radiation is produced after multiple reflection via the silvered end. It is too early to say what uses may be made of such masers, but one suggested application is that of producing infra-red sources of selected frequencies with far greater power than available with present devices.

Infra-red spectroscopy has been extensively used in the analysis of organic compounds, in which field it possesses some advantages over normal methods. Perhaps one example may illustrate the possibilities of some of the newer techniques. Using a method involving a reflecting microscope and polariser, a magnification of $\times 10$ may be obtained and a single fibre, or as little as 1 μg of the sample, can be examined. For any infra-red spectroscopy, however, the maser source mentioned in the foregoing paragraph could prove very beneficial.

The measurement of surface temperatures by methods not involving contact with the surface, particularly at relatively low temperatures, has always proved difficult. Infra-red pyrometry has been of considerable assistance here, a lead sulphide cell or other suitable cell being used as the measuring element. Surface temperatures as low as 100°C have been observed by infra-red methods.

Other significant applications are found in flame failure devices, in methods for destroying aircraft based on infra-red radiation from the aircraft's engines and so on. Many more could be listed, but the foregoing examples should indicate the possibilities of employing frequencies in a relatively little known part of the spectrum.

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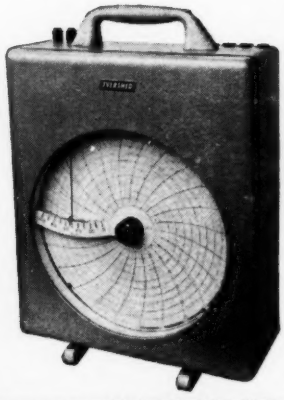

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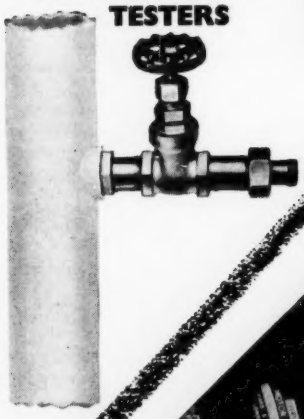

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7/172

Optimising and Feed-forward Techniques

PROCESS CONTROL BY COMPUTER

This article is based on a paper presented by Mr. James and Mr. Lee at the recent Brussels conference on analogue computer control of chemical processes. In it they describe the use of optimising and feed-forward techniques using the de Havilland process control computer ANATROL.

By M. JAMES, Dipl.El.(Hons.), M.Brit.I.R.E. and W. T. LEE, B.Sc.

Introduction

THERE are a number of qualities desirable in an on-line computer, and upon which its design is based. It should be possible to regard an installation initially as a research project and only after experience has been gained to expect it to show improved process efficiency. This indicates that its cost should be within the scope of an instrumentation budget, if possible.

Whatever form the internal organisation of the computer may take, it must have analogue input and output equipment in order to be compatible with existing instrumentation. The standard of reliability in the computer must be extremely high both from considerations of safety and of economics.

The computer must be capable of controlling unit processes such as single distillation columns, single reactors. It should preferably be capable of using some of the mathematical techniques likely to be used in later, more sophisticated control schemes, so that relevant experience may be gained. It should be versatile, capable of being re-programmed for other tasks, or to extend an existing role with a minimum of equipment redundancy or addition.

To conform with the hierarchy philosophy, the computer should be capable of receiving its control targets from outside: at first from human supervision, later from the supervisory computer.

It should be compatible with the speed of response of most processes, characteristic time constants usually being measured in minutes.

In designing the Anatrol computer the conclusion reached was that analogue operation was preferable to digital, for reasons of compatibility and required accuracy, but that conventional parallel analogue computation is unnecessarily fast. A time sharing technique is therefore used.

The Anatrol Process Control Computer

A time sharing principle is used in which the minimum of computing amplifiers and multipliers are formed into an arithmetic unit. This unit is then used to solve the process equations, in a step-by-step fashion, according to a pre-set programme in which each step is selected sequentially by a switch system. Intermediate information as a result of a step in the solution is transferred to a condenser short store, to be used at a later stage of the computation. Long stores are used to clamp the outputs at the last computed figure, while new values are being determined.

Fig. 1 shows the general arrangement of the computer. Up to 25 steps are available, and with only three amplifiers and one multiplier, the computer has the potential of a conventional analogue machine employing up to 75 amplifiers and 25 multipliers. Further amplifiers and multipliers may be added as necessary.

Module construction is used in Anatrol to enable different combinations of circuit blocks to be used according to the problem, and these modules, which include the operational amplifiers and analogue multipliers, checking-units, coefficient potentiometers,

voltage references, switching units, short stores, inputs and outputs, have their active connections brought out to the front via taper pin sockets. This enables a problem to be patch connected via the 25-way switch so that each step of the switch contributes in succession to the solution of the problem.

Reliability

In operation the patching facility is sealed inside the computer to protect it from environmental conditions and accidental alterations. The computer is shock-mounted in a strong casting provided with sealed doors which may be locked, and all cable entries are hermetically sealed. There are relatively few electronic units, as a result of the "time shared" operation, and these embody conservatively rated semiconductor techniques with components mounted on plug-in printed circuit boards.

The overall probability of failure of any equipment is equal to the product of the failure probabilities of the individual components, and since the Anatrol computer is more complex than any conventional plant controller its chance of failure must be high. De Havilland, therefore, recommend that, for the time being at least, the computer outputs should be connected to existing plant controllers so that in the event of computer malfunction these controllers may retain command of the process at the last correctly computed set-point.

To detect a fault all the electronic units are checked every 25 seconds or more frequently. A complete input/output check can be carried out less frequently. Before a freshly computed value is passed to the controller it may be tested for validity against the previously computed value.

Control Objectives

A system of process control which not only adjusts set points statically to approach some defined optimum, but also dynamically holding the process near the optimum even during and after a process disturbance can be achieved using multi-variable feed-forward control. Using a mathematical model of the process, process disturbances may be measured and calculations performed in the computer to establish how, and when, controller set-points should be changed, so that the disturbances are largely offset, thus greatly reducing the effect of the disturbances.

If a sufficiently accurate model of the process is used, feed-forward control can in principle provide better dynamic control of a process than can overall feedback. With overall feedback of a product parameter, no correcting action is taken until a disturbance has travelled right through the process, and the subsequent transient error can persist for several process time-constants.

Process Model

To ensure a product completely unaffected by any disturbances would need a complete model of the process possibly in non-linear differential equation form. As a practical basis for computer control, how-

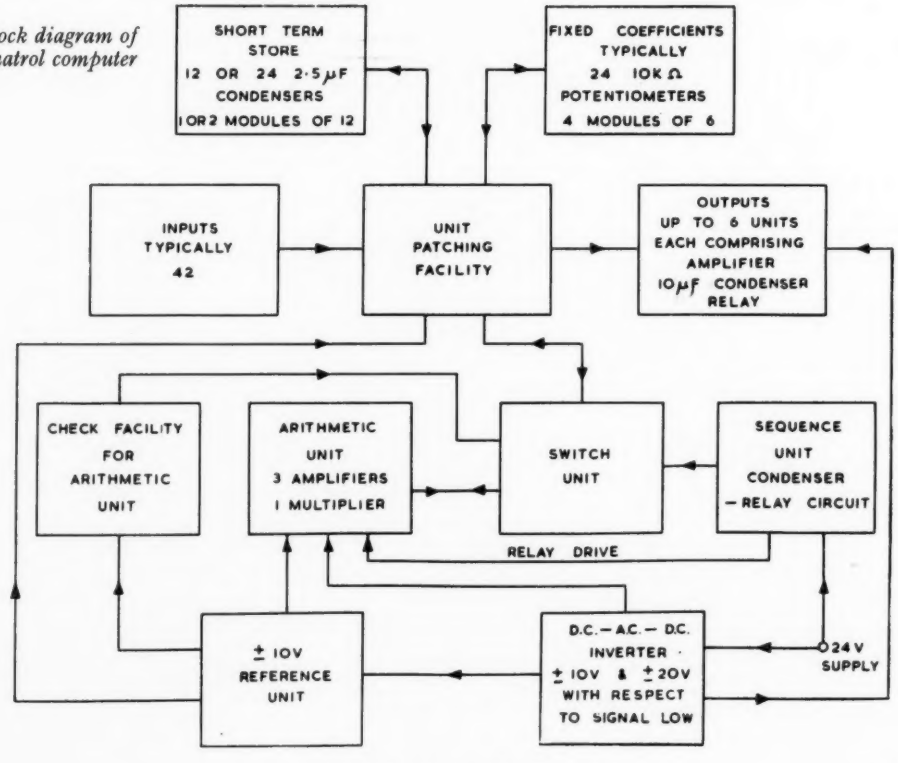
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Fig. 1. Block diagram of Anatrol computer

ever, one may assume that most processes are in a quasi-steady state for most of the time, and serious sharp-edged disturbances occur quite rarely. To phase-in corrective action so as to offset exactly the effects of a disturbance may require a complex transfer function; if in the model this is represented as a first order or, at most, second order transfer function, most of the transient error will be removed. Correcting action will be gradually applied, and only when serious sharp-edged disturbances occur will significant transient errors appear in the product, and these will be of short duration.

In establishing the model for control, de Havilland give the steady-state relationship the greatest emphasis, with a simplified model of the process dynamics being used to provide a fairly smooth transition from each quasi-steady state to the next.

In many cases the flexibility to request specific products is not required; constant products may be desired regardless of disturbances, or the achievement of some optimum may be required. In either case the control functions reduce to ones of the disturbing conditions only, with the control aims implicity built in to the equations. When optimal control is required, additional uncontrolled disturbances, such as market conditions, may enter the picture, and must be incorporated in the model as extra uncontrolled but measurable variables.

Establishing the Model

When considering a process for computer control, or when trying to make it suitable, the first requirement is this: A configuration of controllers must be chosen, the adjustment of whose set-point affects the products at least as much as the expected disturbances, so that their correct manipulation could offset the effects of the disturbances. This being established, the model may be formulated from theoretical considerations, from the statistical analysis of logged data, or by planned plant experiments.

Adaptive Control

Many processes change their characteristics with time and for wide application a computer control system must be sufficiently adaptive to deal with these situations.

Suppose a plant-experimenting optimiser is used in addition to a feed-forward multivariable controller, with the feed-forward controller providing most control action, and the optimiser acting as a trimmer. The operating requirements of both the feed-forward model and the optimiser are considerably eased by the combination. If the model has a 10% error for some condition, then immediately after installation there is a 10% error in control, but the optimiser comes into operation and makes incremental additions to the set-points which finally bring control to within, say, 1%. Any subsequent disturbance sufficiently serious to cause a 10% change in the product without feed-forward control, would be substantially countered by the feed-forward controller, leaving an error of less than 3%, which the optimiser would immediately start to reduce.

Many difficulties lie in the path of any attempt to control a process by an automatic optimiser alone, but when used in conjunction with feed-forward control, these difficulties are minimised.

Speed of Control

The operation of an optimiser alone is to make an incremental change and then waiting for its effect before deciding whether the result is good or bad, to determine the next move. Each step would take of the order of a process time constant. If feed-forward control is used this would offset measured disturbances both statically and dynamically so that the optimiser would only have to provide the last few per cent of each control setting. The proportion of time would thus be correspondingly less.

Process Noise

Changes in the product are the result of uncontrolled as well as of controlled disturbances, and the step size cannot be reduced below the ambient noise level.

The feed-forward model feeds forward a function of measured disturbances, explicitly to offset their effects on the output variables. The Anatrol system of control may, therefore, be thought of as a type of non-linear filter between the measured disturbances and the output variables. Thus from the point of view of the optimiser, process noise may frequently be reduced by at least an order of magnitude, providing more certain decisions and allowing smaller increments.

Response Surface Irregularities

An optimiser for general application must have a complex logic system adjusting step sizes, timing and the order and combination in which step adjustments are made, in order to cope with sharp oblique ridges, saddle-backs, multiple peaks, etc.

In keeping the control set-points always within a few per cent of their ideal values, feed-forward control allows the strategy of the optimiser to be simplified. If there are multiple peaks on the response surface, feed-forward holds the system near the correct one; a simple optimising strategy can no longer result in termination on an oblique ridge, some way from the optimum.

To increase the adaptability of the system the model must be changed to accord with circumstances; this may be done by adding a data acquisition equipment to the system, and having access to an off-line digital computer, the complete system being shown in Fig. 2.

The optimiser has an alarm, operating whenever it contributes more than approximately 10% to any control setting. When this happens the latest logged data is transmitted to the off-line computer, which calculates new coefficients for the model. It is conceivable that this up-dating could be part of the normal weekly or monthly routine operations in the plant.

Conclusion

This article has set out to show that, with the present day level of understanding of process theory, and with the present form and accuracy of measurement signals, an analogue computer is probably best suited to process control. A time-shared on-line computer, that has been designed explicitly for a process environment has been described which provides a control capability from

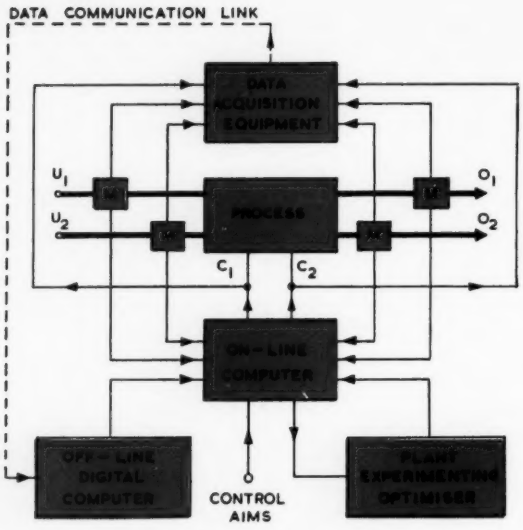


Fig. 2. Adaptive computer control system
M — measuring element
U_1, U_2 — uncontrolled input variables
C_1, C_2 — controlled input variable
O_1, O_2 — output variables

simple feed-forward control to a system sufficiently adaptive to be used on processes whose characteristics are time-varying.

While analogue computers seem to be most suitable for control purposes at the present time, accumulated experience of the new technique may provide a basis for still more advanced forms of control, where the greater capacity of the digital computer for complexity, long-term storage, and logic, may be exploited.

The point has now been reached where the process industry itself should take advantage of these cheap, reliable and relatively powerful computers to prove by demonstration that this type of control can yield the much talked about benefits of better quality, greater consistency and lower costs.

Humidity Effects on Microbalances

Research at the National Bureau of Standards has shown that the rest point of microchemical balances may be seriously altered by changes in relative humidity. Errors may result from absorption of moisture by balance components and surface dirt, and unequal adsorption on opposite sides of the beam. The effect can be minimised by careful design and construction of balance mechanisms, and removal of collected foreign material.

INVESTIGATION at the National Bureau of Standards has shown that the rest point of microchemical balances may be seriously altered by changes in relative humidity[1]. H. E. Almer, of the Bureau's Mass and Scale Laboratory, found that enough moisture can collect on balance parts to move the pointer off scale. Careful design of balance components, selection of materials that absorb little moisture, and maximum cleanliness will minimise this effect.

Traditional means of chemical analysis are being widely supplanted by milligram techniques, which offer the advantage of rapidity and economy. To gain even wider acceptance, however, the newer methods must offer the same degree of accuracy as those they replace. In microanalysis the errors due to weighing are often significant. The identification and reduction of these errors, such as that due to humidity, will increase the useful applications of microanalysis.

In this study, the effects of changes in humidity upon four balances of different design were determined. Two of the balances were of two-pan, equal-arm, construction, and two were of the one-pan, direct-reading type. The humidity in the balance case was determined by an electric hygrometer. The balance indication was recorded for a short period to show the performance under room conditions. Moist air was then introduced into the balance case. After this the balance indication was recorded while the moisture escaped from the case and the air enclosed returned to ambient conditions. When large changes in rest point were noted, the balance was carefully cleaned, including the removal of lacquer and excess cement. The test was then repeated.

To determine whether certain balance parts were unusually sensitive to changes in humidity, they were weighed in a closed chamber, in which a pan was suspended by a wire from a balance above. The relative humidity in the chamber was altered, and any change in weight was detected by the balance. In this way the part could be checked at various levels of humidity without affecting the weighing instrument.

Each of the balances tested reacted to changes in relative humidity, reaching a new rest point quite rapidly. The magnitude of this change was different for each balance, one actually going off scale during the test. The effect on this balance was greatly reduced by removal of lacquer and excess cement. The performance of another balance that showed large deviations improved after cleaning. Changes in rest point ranged from over 8 µg for each per cent humidity change before treatment to 0·8 µg after treatment.

The investigation showed that moisture can collect on a balance through adsorption by hygroscopic materials such as lacquer, cement, and dust, and by adsorption on all surfaces. To improve the performance of microbalances, the use of hygroscopic materials should be eliminated wherever possible, and balance parts should be kept free of foreign matter. Design considerations should include uncompensated differences in the coefficient of adsorption, and correction for inequalities in the surface area on either side of the beam.

The response of a balance to changes in relative humidity is unpredictable, and can be determined only by testing of individual instruments.

Reference

1. Response of microchemical balances to changes in relative humidity, H. E. Almer, *J. Res. Nat. Bur. Stand.*, **64C**, 1960, p. 281.

The Rt. Hon. Lord Mills, P.C., K.B.E., Paymaster General (left) with Mr. W. G. Thomas, President, BIMCAM

Sir Hamish D. MacLaren, President of the I.E.E. (left) with Mr. W. T. Marchment, Chairman, BIMCAM

AHEAD WITH BIMCAM

THE Annual Luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association (BIMCAM) was held on 17th January at the Hyde Park Hotel, London.

More than two hundred leading figures in the instrument industry were joined at a cocktail reception and at luncheon by a distinguished company of guests headed by the guest of honour, the Right Hon. Lord Mills, P.C., K.B.E., Paymaster General.

After lunch, the toast of the Association was proposed by Lord Mills. He drew attention to the BIMCAM motto "BIMCAM helps industry into the future". What was the future? he asked. He pointed out that our high standard of living was only maintained by our ability to convert new materials into manufactured goods and export them, and he acknowledged the part that the instrument industry, with its knowledge of measurement and control, was playing in contributing to the efficiency of production and in maintaining quality of goods. The instrument industry had increased its own production over the last five years by 75%, but he asked it, in view of the urgent need, to look again at its export figures.

In his reply, Mr. W. T. Marchment, Chairman of BIMCAM, referred to some of the developments taking place within the industrial instrument industry. He welcomed the growing practice of instrument companies joining together and forming consortiums to deal with the very large jobs which were to be obtained abroad. He also welcomed the increasing number of exhibitions and conferences, which performed a valuable function in keeping industry generally alive to the growing value of instrumentation.

As regards efficiency, BIMCAM was well adapted to play a leading role in any increase demanded since it catered for all industries. On the subject of exports, BIMCAM members were already sending abroad large numbers of instruments both individually and on contracts. He forecast that the next major step in automation would be the development of decision-making apparatus to add to those functions of measurement and control already accepted.

The toast of the guests was proposed by Mr. W. G. Thomas, President of BIMCAM. In his remarks he referred to Lord Mills' great contribution to the country's economic well-being and thanked him for finding the time to be the Association's guest of honour. He drew attention to some of the Association's other principal guests: the Presidents of the Institution of Heating and Ventilating Engineers; the Institution of Chemical Engineers; the Society of Instrument Technology and the Scientific Instrument Manufacturers' Association. He also welcomed the chairman of the Gas Council and the director of the National Physical Laboratory. He announced with regret the absence of BIMCAM's founder-president, Mr. W. G. Ardley. He was sure that the company would agree to his sending a telegram to Mr. Ardley expressing their disappointment of his inability to be with them.

On behalf of the guests, Mr. G. C. Eltenton, F.Inst.P., F.Inst.Pet., president of the Society of Instrument Technology, urged the need for wider recognition of instrument technology as a major science. He pointed out that the rapid advances in instrument technology could be endangered unless the call for trained men could be met. He invited the members of BIMCAM to consider closely the important problems involved in the training of the next generation of instrument technologists.

Electronic Engineering Association

The annual review of the Electronic Engineering Association provides a good picture of the state of the electronic engineering industry.

The electronic industry in this country is now producing some £500,000,000 worth of equipment a year, increasing at an annual rate of 10%. A significant proportion of this goes to the export market which, it is stated, is being maintained against severe competition.

Among the major technical achievements of 1960 was the completion of development of the Autoland system. Autoland enables an aircraft to be guided to the runway and to be landed without the intervention of a human pilot. It will enable airline operators to ignore the weather. This system, by which thousands of test landings have already been made, is the result of close collaboration between the Blind Landing Experimental Unit of the Ministry of Aviation and four of E.E.A. member-companies.

There is an increasing amount of electronic control equipment carried by aircraft—an activity where British manufacturers excel. An example is an amplifier produced to control jet pipe temperature; £16,400 worth of amplifiers is now being supplied for use in French Sud Aviation Caravelles. Rolls-Royce bought these instruments to the value of £100,000 and there are further sales to the Ministry of Aviation. Another interesting instrument is an engine condition analyser which can monitor temperatures and vibration, and give warning of unusual conditions before an engine fault can develop. These are fitted to BOAC's Comet Fleet.

Aviation, however, is only one facet of the activities and the conference organised last year by the Electronic Forum For Industry (EFFI) was of particular interest because it covered the increasing applications of electronics to industries as widely divergent as glass and oil.

During the year there have been important overseas orders, particularly in the fields of v.h.f. and s.h.f. equipment. One of the largest single contracts for communications and control equipment ever placed by the oil industry, worth £1·25 million, is in connection with the 730 miles pipeline project in Northern India. This has called for the design, supply and installation of telecommunications, telemetering, telecontrol and instrumentation apparatus. The system will give a constant check on oil flow along the pipeline, with 34 channels for telemetering, teleprinting and speech transmission.

Research laboratories continue to back up the industry in all aspects of development. One piece of equipment which has successfully passed through the laboratory to the production stage recently is a variable capacitance diode designed for use in parametric amplifiers working in the S-band and selling at a price considerably below similar products from other countries.

In the field of electronic aids to shipping a new range of 10 cm radar was announced during the year. Other equipment developed and supplied range from a transistorised portable direction finding receiver, giving bearings accurate to $\pm 1^\circ$ to the equipment carried on the Orient liner *Oriana*.

Fishing vessels are now equipping with electronic navigator equipment to enable them to engage in Seine-net fishing more economically.

Sound broadcasting and television equipment was supplied during the year to Radio Hong Kong, New Zealand, Australia and Eastern Nigeria.

An improved product at a better price sums up the impact of electronics on industry. Machine control systems and automatic methods of optimising the operation of complex processes dominate the industrial picture.

Introduced during the year were several control systems for milling and boring machines, one of which anticipates error. By cross-checking the control tape with work already done and instructions for future work, the control can foresee any programme error or irregularity in the tape so that safety circuits can operate before the cutter reaches the position which is in doubt.

The manufacturers of machine tools now appreciate that the fullest advantage of electronic control can be taken when the tool is developed in parallel with the control system. This realisation has resulted in closer liaison between the toolmaking industry and the electronic firms. The result of their co-operation has brought the cost of many automatically controlled machines to a point where they are only marginally more expensive than their manually-controlled counterparts. The idea that electronic programming is expensive has been amply disproved.

Several British firms have linked themselves with overseas companies, a move that has resulted in an increase in the already satisfactory international sale of British industrial electronics. At least two of these combinations have resulted from direct approaches from United States manufacturers who now accept the superiority of several of the British systems.

One firm has been responsible for the complete instrumentation and commissioning of the Assam Refinery, being built by the Roumanians for the Indian Government. Another important overseas order was for automatic control equipment for a new zinc smelting plant to be built at Noyelles-Godault in Northern France.

The British firm concerned specialises in control equipment for zinc plants and received total orders for £250,000 worth of equipment in this field. The system, however, is versatile and is used in such diverse activities as road stone blending, chocolate manufacture, bread making and preparing breakfast cereals.

Industrial television has grown into an important

field of activity. Extensive use is made of television systems in the steel industry and it is now being more widely applied to commercial undertakings. American brokers on Wall Street are among the big buyers of British equipment.

All companies engaged in the production of instruments report a considerable increase in business. This can be put down to the growing use of controlled processes in industry and increasing research activities coupled with the particular inventiveness of British designers in this field. An example: while instrument manufacturers all over the world were searching for practical, portable sound-measuring apparatus, a British firm was able to go into production with a completely transistorised instrument, the first of its kind to meet international requirements.

The techniques of using masers for extremely low noise amplification has now passed from the laboratory stage. In conjunction with the Royal Radar Research Establishment, masers have been developed industrially for use, initially, on radiotelescopes. The 83-foot diameter radiotelescope at Bonn University Observatory is using British-made travelling wave tubes in dual-channel amplifying equipment used for outer space temperature research. A radiotelescope at Parkes, New South Wales, weighing 800 tons, will be controlled by a British-made servo system. All the electrical equipment associated with it and an elaborate inter-communication system will also be British.

Medical electronics represents a wide and rapidly-growing field of activity. A 4-million electron-volt linear accelerator for the X-ray treatment of deep-seated tumours for the Cancer Institute Board of Victoria is being built in Britain at a cost of £60,000. An electronic method of reading a patient's blood pressure throughout an operation has resulted in orders totalling more than £30,000.

The interest in British instruments in Russia was shown at last year's exhibition in Moscow, when several of the electronic firms reported that all their instruments, even those which were intended for exhibition only, were sold and resulted in further orders.

The use of data processing methods is estimated to be more than doubling itself every year. Even so, only the fringe of industrial, commercial and research potentials has been touched. It is a field of electronic activity that holds out remarkable possibilities of development and one in which British firms are now beginning to reap the benefit of big research programmes which have been in operation for several years.

Many industries are now using data processing systems for the physical control of complex processes; the achievement of optimum working conditions is particularly valuable in the refining of oil and in chemical plants. The steel industry is particularly interested in computer techniques.

A new data processing system, the result of joint efforts by two large companies, was announced during the year and within 6 months orders worth £2,000,000 had been received, a high proportion from overseas. A computer has been built for experiments in air traffic control on the North Atlantic routes. British banking houses are actively engaged in studying plans to introduce full data processing—including electronic cheque reading—throughout the country.

From the technical point of view, principal developments have been towards higher operating speeds, all-round "ruggedisation" and improved methods of feeding information to the computers and printing out results. One company markets a system in which a switching time of 5 milli-microseconds is achieved—roughly the period of time it takes light to travel five feet.

In the field of nucleonics an all-British hand and clothing monitor which simultaneously detects alpha or beta contamination on the hands and clothing of personnel, and which uses a special dual phosphor technique, has aroused interest internationally and has been demonstrated in Russia. These are used extensively by the Atomic Energy Authority.

Another typical piece of British nucleonic equipment is a specialised data processing system which measures several thousand temperature points in a nuclear reactor and can indicate not only the present state of the reactor but trends of temperature changes and give advance warning of any impending crisis. This apparatus has several other industrial applications and is used in one of the most modern steel plate mills.

Another item of development of particular importance is the adaptation of simulation techniques for the training of reactor controllers.

Associated Electrical Industries

Some of the achievements and developments in the field of instrumentation which took place during 1960 are outlined below.

Mining Instrumentation

In the South Yorkshire coalfield a tower-mounted 2,700 h.p. Ward-Leonard geared winder was commissioned at Brodsworth, near Doncaster; the AEI twin-pinion single-reduction gearbox for this winder transmits 5,400 h.p. peak load with a speed reduction of 600/60 rev/min. The winder is provided with closed-loop speed control by means of an amplidyne and high-accuracy servo system. Winding can be carried out either manually or automatically by push-button control. Manual control is provided at desks at the bank and at the top of the tower. The desk at the bank is suitable for both manual and push-button control, and is equipped with a selsyn-driven depth indicator. The controls for the AEI mine-car handling system at the surface are also mounted on this desk.

The North British Rubber Company, Dumfries, have commissioned an AEI electrical drive for the reel-up

of a spreading machine which produces conveyor belting for coal mining duty. The control equipment provided for this drive was designed to maintain the tension in the material constant throughout a wide speed range of take-up linear speeds. This is achieved by means of the "dancing" roller technique in conjunction with a closed-loop control system for governing the speed of the driving motor.

An order for the Broken Hill Mining Company (Rhodesia), which will be completed this year, will enable a mine winder to be controlled from the cage. An inductive loop system will provide the control link between cage and winder house.

Metal Processing

An interesting new development is the application of germanium rectifiers to the continuous tinplating of steel strip. An order received from the Steel Company of Wales Ltd. for their Trostre Works is for twenty germanium rectifiers having an aggregate current capacity of 202,100 amperes.

The tinning line comprises a cleaning tank, two pickling tanks, eight plating tanks, and a chemical treatment tank, through which a continuous steel strip is passed in sequence, the thickness of the tin coating deposited on the strip being determined by the relationship between plating current and the speed at which the strip is passed through the tanks. The speed of the strip can be varied between 250 ft/min and 1,500 ft/min, and the electronic control gear which is being supplied by Electronic Apparatus Division will automatically maintain the relationship between current and strip speed correct and constant to within $\pm 0{\cdot}5\%$ at any speed within the range.

The Electronic Apparatus Division supplied the first audio-frequency inductive loop communication.

A 4-digit dekatron counting equipment for use on a reversing strip mill was supplied to John Summers Ltd., Shotton. The purpose of the equipment is to ensure that the pay-off reel is never completely empty during the rolling process. To achieve this the turns during reeling are counted. When paying off, the drive is first reduced in speed as the end of the reel approaches, and then stopped when the turns remaining amount to one or two.

The maximum number of turns per reel is approximately 4,000, but the counter is capable of counting up to 9,999.

The impulse voltage necessary to trigger-off the counter once per turn of the reel is derived from a unit coupled to the reel. This comprises a rotating permanent magnet and stationary semiconductor, which is influenced by the variable intensity magnetic field produced by the rotating magnet. This characteristic of a semiconductor, known as the Hall effect, provides a reliable triggering voltage down to zero speed.

Machine Tools

Recent development work has been carried out to produce, on an experimental basis, a miniature Helixyn. This is similar to the standard Helixyn used in machine tool control but has a bar diameter of approximately 0·5 in. and a cycle length of 0·5 mm. Control or indication of linear positioning to an accuracy of 1 micron can be achieved, compared with 2·5 micron for the standard Helixyn. This new development will not replace the standard Helixyn system already in use for machine tool control.

The steady demand for Asquith horizontal borers with electronic feed control has been maintained during the year. Seven borer control equipments have been commissioned and twelve more have been ordered.

In the latest designs the Ward-Leonard generator field power is provided by an exciter controlled by a transistor regulator. This replaces the thyratron field supply and valve speed-regulator used on earlier equipments. The transistor amplifier components are mounted on printed circuit boards.

A Kearns No. 3 WB horizontal borer with two-dimensional co-ordinate setting control was shown at the 1960 Machine Tool Exhibition at Olympia. Orders for several two-dimensional control equipments for Kearns machines have been received. All the Kearns equipments are now provided with an "Auto-position feed" feature which enables the machine to mill while positioning.

Aircraft Equipment

Of particular interest is the new small push-button operated, three-phase thermal overload circuit-breaker, Type LGC, which is the first of its type to be developed for aircraft use.

Another new development is the range of small toggle switches, suitable for use in either d.c. or a.c. circuits. These small switches can be supplied with single-, double-, triple- or four-pole configurations. They can be arranged to give a variety of switching operations, and can be spring-biased in any particular position, or fitted with a special gate mechanism so arranged that it will lock the switch in any desired position to prevent inadvertent operation. They can also be supplied with a miniature light bulb in the operating handle with arrangements made for the bulb to light up in a predetermined position, as a warning or other form of indication. All these toggle switches have been designed to meet the onerous conditions experienced in aircraft, and they incorporate a wipe double-break action, and are sealed against the ingress of moisture.

Computers

The AEI 1010 data processing system has now passed through final stages of its development programme.

During the year a very large order (valued at £620,000) has been received covering the installation of an AEI 1010 data processing system for the Royal Air Force, for carrying out the work of spares provisioning and stock control on a world-wide basis. It is believed that this is one of the largest projects of its kind in the world; the computer will be called upon to handle the records for approximately 750,000 items and deal with 2,000,000 incoming messages each month.

The demands for equipment and supplies from depots and units in the United Kingdom and overseas will be transmitted over telegraph circuits to the Supply Control Centre near London. There the computer will automatically maintain records of R.A.F. requirements, holdings, stock consumption, procurement and repair contracts, re-distribution of stock, consignments in transit, etc., all on magnetic tape. The computer will

also give over-riding priority to urgent demands without interrupting routine operations, and is capable of processing such demands within seven or eight minutes.

The first film produced by the AEI film unit has been made on the AEI 1010 data processing system entitled "The AEI 1010 in Industry". This film is intended to show how the AEI system can be applied in industry to ensure the rapid and smooth working of such requirements as inventory control, accounting, invoicing, and the many statistical reports required giving up-to-the-minute information.

An AEI 955 analogue computer has been supplied to the Ford Motor Company. This computer will be used in their Engineering Research Department to simulate design problems in modern motor vehicles.

Servo Equipment

During the year continued progress has been made to replace thermionic and magnetic amplifiers by semiconductor types, and new equipments have been engineered, both for the Services and industry, using transistor techniques.

Development work is being carried out using silicon controlled rectifiers with the aim of extending the power output of semiconductor devices and hence replacing some types of rotating machines.

A noteworthy advance has been made in the use of programmed equipment. Two developments have been completed and commissioned successfully. The first is in the textile industry. Programmed control has been applied, through a punched tape system, to a hosiery knitting machine, and will replace mechanical patterning chains. The second development has been applied to the manufacture of instrument scales. Here the programmed control is used to produce automatically the accurate scaling on rulers, gauges, etc., and has dispensed with tedious manual operations previously employed.

An automatic screwdown control has been commissioned during the year for Messrs. Steel Peech and Tozer. This scheme involves the use of magnetic amplifiers controlled from a coarse-fine synchro system. These in turn excite amplidynes for the control of the rolling mill screwdown motors.

The first automatic power control gear for the Glasgow Suburban Railways has been developed and the commissioning completed. The supply system is at 25 kV, dropping to 6 kV under bridges. The equipment automatically senses the overhead line voltage and changes the taps on the coach transformers when a change in the line voltage occurs, thus providing a constant secondary voltage.

In August the control equipment for the new 210 ft diameter radiotelescope for Australia was installed at the trial erection in Gustavsburg, Germany, prior to shipment to Australia. From these initial tests, which were satisfactory, the overall design was proved.

Semiconductors

A great deal of development work has taken place on miniature diodes. Steps have been taken to improve the efficiency of production methods for point contact germanium diodes, and to determine processes necessary to obtain optimum yields of those types most in demand.

The development of gold-bonded diodes has been completed for high-speed computer and communication equipment and they are now in production. Further development work is aimed at producing diodes with even faster operating speeds.

A range of miniature silicon junction diodes has now been developed and manufacture has commenced. These diodes have ratings of 60 volts to 300 volts at 150°C, and a maximum output of 250 mA at 25°C.

Miniature voltage-reference diodes have also been developed and will shortly be in production.

Development of the Type CS9-B point contact silicon radar mixer crystal has been completed and it is now in production. A version of this crystal with a lower noise factor (SC10-B) has been specified and this is expected to be available shortly. A new range of X-band low-level detector diodes has been developed and these are already available in limited quantities.

Silicon junction diodes have been given considerable attention during the year. A modified version of the 1 amp diodes with a smaller outside diameter is now in production. The basic unit has also been redesigned to allow higher-voltage units to be manufactured. The 10 kV 0·5 amp e.h.t. potted rectifier has been put into production.

The 10 amp silicon junction diode was put into production early in the year. To satisfy National Coal Board requirements, these rectifiers are being moulded in epoxy resin and are required to operate at 150°C. A range of finned bridge assemblies has been developed and is now in production. They are of an extremely rugged, vibration-proof design, using die-cast end brackets.

A considerable number of 100 amp silicon junction diodes have been supplied during the year for use in aircraft.

In November, 1959, AEI introduced the silicon controlled rectifier and was the first company in Great Britain to commence production early in 1960. Development has continued throughout the year and has resulted in improved characteristics for the device, and lower prices.

A new series of 25 volt h.f. germanium transistors has been introduced during the year. In addition, an avalanche transistor, Type GT60, has been developed and samples can be supplied. This latter device is a medium-speed transistor suitable for pulse generation or frequency division.

As well as the normal development and rating of new devices, a considerable amount of investigation work has taken place in connection with test equipment and measuring techniques. These investigations include the measurement of switching transistors on charge control principles, surge tests on transistors to test the suitability for triggering controlled rectifiers, special diode measurements including slope-resistance matched to 1 part in 10^4 and matched pairs at 130 Mc/s, measurement of high precision reference diodes accurate to 0·01 mV/°C, encapsulation leak experiments using radioactive gas, and measurement of controlled rectifier characteristics.

Large orders for semiconductors include one, comprising 14,500 germanium transistors and 55,000

germanium point-contact diodes, from an aircraft/electronics manufacturer. Microwave diodes and germanium rectifiers to Service specifications have also been ordered in large quantities.

For use in television sets a total of 220,000 germanium point-contact diodes have been supplied to one customer.

A particularly interesting series of large orders has been received from a manufacturer of electronic control equipment. These are for silicon voltage reference (Zener) diodes, which are used in place of standard cells in precision recording potentiometers. Only AEI diodes are specified and tested in such a way that the required accuracy can be achieved in the instruments.

Crompton Parkinson Ltd.

The past year has seen the introduction, for the first time in this country, of a range of 2 in. and 2½ in. dial moving-iron 240° circular scale instruments. Available in both moulded plastic and die-cast metal cases, these instruments can also be supplied in sealed cases to withstand the standard Admiralty shock test and are appreciated wherever long scale length in the smallest possible panel space is needed.

All moving-coil short-scale instruments of the switchboard and portable patterns have been redesigned and now incorporate coaxial magnet systems of high efficiency.

Introduced only within the last two years, the "New World" circular scale switchboard instruments with their attractive design are proving to be one of the most popular in the wide range of Crompton Parkinson instruments available to industry.

The main emphasis of the company's overseas activities during the year has been once again on developing new markets. Special efforts have been made to sell the company's industrial a.c. motors and instruments in the U.S.A. and to develop the sale of fractional horse-power motors in Scandinavia.

English Electric Valve Co. Ltd.

A programme of factory extension and rearrangement has been maintained throughout the year and this has resulted in greater production efficiency and allowed an overall expansion in the range of electronic valves and tubes to over two hundred and fifty types.

The company announced that orders for the first high-power klystron to be designed specifically for use in commercial radars have been received for service in New Zealand, Denmark, India, Italy and Great Britain. The first of these K347 klystrons was supplied for use in the 500 kW, 50 cm surveillance radar at Rongotai Airport, Wellington, New Zealand.

An agreement was signed during the year with Eitel McCullough Inc. of America for the exchange of technical information and know-how on klystrons, travelling wave tubes and power valves. This agreement effectively enlarges the range of tubes of both companies and enables the production of a composite range of each other's products in these important fields. The 4KM50 000LA high-power klystron which went into production during the year, and is used in band IV television transmitters and u.h.f. scatter propagation, is built by the English Electric Valve Co. Ltd. under licence to Eitel McCullough Inc.

Among the new reflex klystrons introduced during the year the K357 is noteworthy for its use in the Marconi doppler speed measuring equipment which has been ordered by police forces all over the country. Production also commenced on the K359, a reflex klystron, designed for operation in airborne equipments as a local oscillator.

Several new magnetrons were added to the English Electric range during the year, including the M559 airborne radar magnetron and the M566, a long anode high-power radar magnetron.

English Electric long anode magnetrons, which have a higher mean power than any other contemporary design, have been used in military and civil long-range radars for airfield and sector control. An M543 long anode magnetron has been used by the Royal Radar Establishment at Malvern in experiments to determine the nature of the moon's surface, and an M554 conventional high-power magnetron has been installed at Orly airport, outside Paris, in a c.s.f. long-range sector surveillance equipment. These are but two examples where English Electric magnetrons are associated with outstanding projects. There are many other instances where the long life, high mean power and absolute stability of these valves demonstrate a significant technological advance.

Image orthicon television pick-up tubes continue in popularity with television services and the company's strength in this market is demonstrated by the export order book which includes over thirty countries regularly receiving camera pick-up tubes by airfreight. The latest television studios opened in 1960—the B.B.C.'s "Studio 3" and Associated Rediffusion's "Studio 5"—are equipped with television cameras using English Electric 4½ in. image orthicon pick-up tubes.

English Electric travelling wave tubes were used during the Olympic Games in a microwave radio link, of Marconi Italiana manufacture, between Naples and Faito, which was used to transmit the programmes of sailing events to Italian and European networks. Travelling wave tubes were also used in the Trieste-Jugoslavia link for Eastern European transmission.

Other travelling wave tubes have also proved successful in radar equipments, where they are used as low noise input amplifiers.

The "Remscope", manufactured by Cawkell Research and Electronics Ltd., which uses an English Electric E702A storage tube, has found a wide variety of new applications such as the measurement of transient accelerations in missiles and as a display device in analogue computers. The "freezing" of a television picture by means of a specially developed storage tube and the introduction of new vapour-cooled valves for communication and r.f. heating equipment are other highlights of another successful year of trading and progress.

General Electric Co.

During the latter part of 1960, merger discussions took place between the G.E.C. and the English Electric Company. The boards, however, were unable to arrive at a mutually satisfactory agreement so the discussions were ended.

Research

In addition to general work on microwave generators and amplifiers, studies are being made of various types of very low noise amplifiers with good bandwidth properties. These include electron beam versions, amplifiers using specially developed semiconductor diodes, and types using synthetic ruby or other paramagnetic crystal elements. The transmission properties of waveguides filled with ionised gas reveal new possibilities for amplification and power generation in the millimetre wave field.

As a contribution to the Atomic Energy Authority's nuclear fusion projects, mercury vapour switches capable of controlling a very large current have been developed at the Research Laboratories. These switches, evolved from single-anode steel tank mercury vapour rectifiers and having some similarities of construction, conduct pulse currents of 130,000 amp and withstand voltages of 40 kV.

Fundamental research is in progress on new phenomena associated with the superconductivity of metals at the very low temperatures obtained by using liquid helium refrigerants.

Studies of the mechanical properties of very pure metals have shown that recovery and recrystallisation after deformation at low temperatures are sensitive to traces of impurities in amounts as small as 10–100 parts per million.

New methods have been developed for dispersing in pure metals refractory oxide particles of extremely small size. Significant improvements of the tensile properties of copper and nickel have been achieved with particles less than $\frac{1}{2}$ micron in diameter without affecting electrical and thermal conductivity.

The potential importance of thin magnetic film as a basis of quick access stores in digital computers has been confirmed. Higher speeds than those of conventional storage systems can be obtained at lower costs. Experimental 200 × 25 matrices have been constructed for appraisal, and manufacturing techniques are being developed. Basic studies include development of apparatus for the visual display of domain patterns which provide a useful means of studying the behaviour of the films.

For some years the Laboratories have been studying semiconductor thermo-electric materials which combine the features of good Peltier cooling with minimum Joule heating and thermal conduction.

The first commercially available thermo-electric cooling unit in the U.K. was marketed by S.E.I. during September last year. This is designated the B.T.4 with a capacity of 1 watt and is the first of a line up to 10 watts which are now available. This range of coolers is aimed at the instrument market rather than domestic refrigeration and fills a gap below the capacity of conventional refrigeration systems. Typical of this instrument application is the thermo-electric hygrometer, also introduced in 1960 by S.E.I. By adaptation of this basic hygrometer, gas water contents as low as 50 parts per million can be measured and their variations continuously recorded.

Increasing emphasis is being placed on the practical applications of these materials and a range of four cooling devices is now available in experimental quantities for assessment and use in industry. They incorporate junctions between p- and n- thermo-elements of bismuth-antimony-telluride materials and, under conditions of zero heat absorption at the cold face, are capable of developing a temperature difference of 80°C between the hot and cold faces. This ideal condition of operation can be approached only in a suitable vacuum environment.

Smaller temperature differences are exhibited when the cold face is required to absorb heat. For a typical temperature difference of 40°C the coefficient of performance is a maximum at a current of 10 amperes and the cooling powers of the units are then $\frac{1}{4}$, 1, 3 and 8 watts respectively. Maximum cooling is obtained at some 17 amperes.

The new technique of gas chromatographic analysis has been developed and adapted to the examination of gases used in different fields of the company's activities. For example, gas filling for lamps, gas reactions in nuclear systems, gas atmospheres for welding and furnace atmospheres used in the production of lamp-black. Impurities in the rare gases have been determined at the level of a few parts per million.

Engineering Group

A new method of achieving either speed or torque control of a.c. winder motors has also been developed and incorporates bi-stable magnetic amplifiers. In conventional a.c. winder equipments, liquid controllers are used for introducing continuously variable resistance in the rotor circuit of the motor.

In the new scheme, the place of the liquid controller is taken by groups of grid resistors which are cut out

successively by contactors controlled by bi-stable magnetic amplifiers. The magnetic amplifiers act as static switches which only permit current to flow to the contactor closing coils when they are magnetically saturated.

Applied Electronics Laboratory

The new G.E.C. Applied Electronics Laboratory was officially opened last October at Portsmouth. It is one of a group of three operated by the company on behalf of the Ministry of Aviation and engaged on research and development of electronic equipment for defence purposes.

A feature of the new Portsmouth laboratory is the extensive range of mechanical and climatic test equipment which is used to test prototype equipment to ensure that it will operate successfully throughout its service life.

During 1960 a completely new range of machine tool position and sequence control equipments was introduced by G.E.C. Electronics Division.

Both systems make use of a series of "logic boards" and use transistorised printed circuits and cold cathode valves. They are considerably smaller than conventional equipments and the virtual elimination of electro-mechanical control gear reduces maintenance to a nominal routine check.

Semiconductor Division

In November, 1959, total weekly output at the Hazel Grove factory was 120,000, but by November, 1960, it was approaching 250,000. In 1959 the plant employed some 700 people and last year this number jumped to 1,700.

In October the Division acquired one of Lancashire's largest and finest mills at Reddish, near Manchester. Hazel Grove had been expanded to the limit and more space had to be got to continue the expansion programme, in order to keep pace with increasing demand for G.E.C. transistors and other semiconductors.

The new factory will be known as Broadstone Works and it is now being converted for its new role. Production is due to start by mid-1961 and the new factory will provide working space of 600,000 sq. ft.

During the year many new devices were added to the range. The most important were the silicon controlled rectifiers, parametric amplifier diodes—the first of their kind made in this country—subminiature junction and point-contact diodes, high power Zener diodes and silicon r.f. transistors.

Salford Electrical Instruments

The redesigned version of the Selectest, a multi-range test instrument, was introduced to the market during the year and was highly successful. Lighter, smaller, with improved technical performance, this is claimed to be the first test instrument of its class to use printed circuit techniques in its construction and will form the basis for a complete new range of test equipment.

New additions to the Salford range of thermostats include a room air thermostat, a fixed temperature commercial thermostat, a unit for refrigeration compressors, combining both protector and starting relay, and a miniature motor protector for embedding in motor windings.

A new selenium rectifier was developed and produced during the year for inclusion in the latest G.P.O. high sensitivity telephone, acting in an automatic volume control circuit. This design encloses the rectifier inside a moulding ensuring reliability of service even under tropical conditions.

THE PRODUCTION OF FRAME GRID VALVES

THE production of frame grid valves by Mullard Ltd. commenced some years ago. Frame grid valves at that time were regarded as highly-specialised devices, and as such their numbers were small and their cost high. The situation has now changed, however, and the successful development of this type of valve for television r.f. and i.f. stages ranks as one of the major technological developments in the industry.

Some estimate of the progress that has been made in this field might be judged from the fact that the Muilard company now has five factories contributing to the economic production of frame grid valves. One of these is situated at Mitcham, Surrey. Another is situated at Hove, in Sussex, and there are three in Lancashire.

Economic production of frame grid valves in large numbers has not been easily attained, and many problems, technological and otherwise, have been encountered before being ultimately resolved. The solution of these problems has resulted in the establishment of some of the most significant of recent advances in television design. As a result manufacturers have been enabled to produce receivers of much improved performance, but at no extra cost.

Two major improvements in design have been established arising from the higher stage gain, lower noise figures, and smaller internal capacitances provided by the frame grid valve. In the first place fewer valves are required in receivers intended for normal reception areas; secondly, highly-sensitive receivers can be produced for fringe areas without the need to use additional valves.

The increased slope of the frame grid valve is a result of much reduced grid-cathode spacing. For example, of the Mullard valves, the conventional Type EF80 has a slope of 7·4 mA/V, and a spacing of 100 microns, whereas the frame grid Type EF184 gives a slope of 15 mA/V, largely due to the grid-cathode spacing being reduced to 50 microns. It is not possible to obtain

spacings of this order with normal grid structures, for the backbone of the grid cannot be made sufficiently rigid, nor dimensions controlled accurately enough to maintain the exceptionally close tolerances involved. In addition, the very fine winding wire, approximately 10 microns in diameter, which would be necessitated by such close spacing would render the entire structure too weak to be practicable.

Strength, rigidity, and dimensional control are achieved in the frame grid by making the backbones of stiff molybdenum rods, held apart at a determinate distance by spacing bars. It is found that such a structure, in which strength is inherent in the frame rather than in the winding, provides a precisely-dimensioned frame on which wire of any desired thickness can be wound. The grid-cathode spacing is determined by the diameter of the backbones and the thickness of the precision cathode.

The manufacture of frame grids is a micro-precision process. It is essential that all constructional operations are carried out to extremely close tolerances; the support rods are drawn to an accuracy of ± 5 microns and the grid wires to $\pm 0{\cdot}2$ microns. The materials from which the grids are made must be of an extremely high order both metallurgically and dimensionally; these conditions are complied with by Mullards by the use of materials made in their own wire factory.

The molybdenum support rods and the strip used for the cross-pieces are loaded into electronic-controlled automatic machines which space the supports in their parallel axes, feed the strip at right angles to them, and weld the first set of strips to each side of each rod, cutting off the welded lengths from the stock in each case. The work is then moved along to the next cross-member position and the operation is repeated, until a "ladder" structure nearly 3 feet long is produced. The "ladders" are inspected under magnifiers for welding imperfections and are then cut into lengths of nine frames, heat treated to remove stresses which might tend to distort the structure, and are finally mounted successively in automatic winding machines.

Extremely fine tungsten wire is used for the windings, being less than $\frac{1}{2000}$ in. in diameter. The wire is wound under sufficient tension to ensure freedom from sag, and under dust covers in the interests of cleanliness. The support rods are then painted with a suspension of powdered glass in a quick-drying medium, and the lengths stoved at a temperature of approximately 750°C so that the glass melts and flows into a thin film, bonding the grid wire supports. The lengths are then cut into individual grids and are stoved again to remove oxidation products.

The accuracy of the frame grid valve has contributed to other advances in valve design, improvements having been found necessary in certain other components. Of necessity, new cathode coatings and new methods of spraying have had to be devised, and mica supports now have to be made to closer tolerances.

Because of the exacting limits on the electrode structure of the frame grid valve, and the close tolerances on its electrical characteristics, rigorous control of quality is necessary to permit economic production in the required quantities.

Mullards operate a system of testing that works on a batch-sampling basis. After each valve has been tested on the production floor the flow of valves from the factory is divided into batches of some 3,000. Approximately 150 valves are taken at random from each batch and are subjected to exacting visual inspection and to electrical tests. Later the batch is re-inspected by a final test organisation. Should a sample batch of 150 valves fail in any one test to conform to the specified acceptable quality level (AQL), the whole batch is returned to the factory, where every valve is then re-processed and re-tested. At regular intervals a smaller number of valves is even more closely examined, and is subjected to life-testing.

Mullards claim that in a television receiver the overall sensitivity of a complete "frame grid" front end can be six or eight times better than that of a conventionally valved circuit. Furthermore, the improved control of valve characteristics made possible by this form of grid construction results in noticeable freedom from the breakthrough of sound upon vision.

BOOK REVIEW

Translation from Russian for Scientists. *By C. R. Buxton and H. Sheldon Jackson, Blackie and Son Ltd., London,* 1960. 300 *pages.* 30*s.* 0*d.*

Russian has long ago graduated as one of the languages in which a substantial amount of scientific information is available but the difficulties of making use of it are not negligible.

To alleviate the agony of the Cyrillic alphabet the authors have taken advantage of the fact that many scientific terms have an international flavour. They collected some 450 words (such as vector, canal, farad, schema) to get your eye and mind accustomed to reading Russian words. Phrases and grammar follow, the examples being chosen from everyday scientific and technical life, such as "the work has not yet been done" (p. 47), "the biochemist said he would attend the meeting" (p. 72), "it is possible to pass through . . . only if we launch the rocket vertically" (p. 124), and several hundreds of others, some completely translated, others annotated.

The basic sciences of instrument technology, physics and engineering are well covered by some 90 verbatim extracts from Russian textbooks and periodicals, chemistry and chemical engineering by some other 70. In studying these you will discover terms and facts already known to you and advance from there to those which are novel and new.

Sandwiched in between is a scholarly treatise of Russian grammar, well worth returning to even after one has acquired a good knowledge of the language. A list of more common abbreviations is included, as well as a short dictionary.

The publishers and printers have done an excellent job of work at a reasonable price and the book can be well recommended to all who are looking for a self-contained course, capable of giving a reading knowledge of scientific Russian.

L. A. STEINER

SIMA Notes

The Half Yearly General Meeting of the Association took place at the Connaught Rooms on Thursday, 19th January. Over 90 members, representing 64 member companies, attended the meeting. At a luncheon subsequent to the meeting, Sir Richard Powell, K.C.B., K.B.E., C.M.G., Permanent Secretary of the Board of Trade, was the guest of the Association.

SIMA Review

The first issue of the SIMA Review was published during January. This will be published at six-monthly intervals in January and July. It takes the place of the former SIMA Bulletin which appeared at two-monthly intervals. The policy of this is to give publicity and prestige to the British Scientific Instrument Industry as a whole. While providing a permanent record of the activities of the Association, it is intended to be rather more than a domestic journal of the Association. It will include articles both on technical and commercial matters of interest to the industry and will also review new developments and applications in the field of instrumentation which will be of interest to users. It is intended to provide statistics on the growth of the industry and it is hoped will be of interest to users of instruments as well as to manufacturers. It will have a wider circulation both at home and overseas than did its predecessor. Additional copies are available to members, price 7s. 6d.

Moscow

The arrangements for the SIMA participation in the British Trade Fair in Moscow are now nearly complete. A wide variety of instruments will be on show on four island stands in Hall C which also houses the British Government Exhibit on "British Scientific Achievements". SIMA's previous experience in exhibiting in Moscow has proved most useful in planning this operation. As on the previous occasion, members' exhibits will be sent by trailer lorry convoy direct to the Sokolniki Park in Moscow. This has considerable advantages, reduces the weight and bulk of packing and the exhibits are all available at the same time and can be put to work very much more rapidly after arrival. The arrangements, as before, are being co-ordinated by Lep Transport Ltd. and the stand design and construction is being organised by Lep Exhibition Contractors. The following firms are taking part in the SIMA display.

Advance Components Ltd.
Avo Ltd.
Cossor Instruments Ltd.
Cambridge Instrument Co. Ltd.
Dawe Instruments Ltd.
Electronic Instruments Ltd.
E.M.I. Electronics Ltd.
Fleming Radio (Developments) Ltd.
Endecotts (Filters) Ltd.
Goodmans Industries Ltd.
Griffin & George (Sales) Ltd.
J. Langham Thompson Ltd.
Elliott Bros. (London) Ltd.
Mullard Equipment Ltd.
Negretti & Zambra Ltd.
Solartron Electronic Group Ltd.
Telequipment Ltd.
Ultra Electronics Ltd.
The Wayne Kerr Laboratories Ltd.

At the invitation of the Royal Society SIMA is co-ordinating a British Exhibit of Scientific Instruments in conjunction with the 5th International Congress of Biochemistry which is being held in Moscow from 10th to 16th August, 1961.

15th Annual Dinner Dance

The Annual Dinner Dance of the Association will be held at the Dorchester Hotel on Friday, 14th April.

Assistant to the Director

Mr. F. D. Outridge, F.C.C.S., has been appointed Assistant to the Director of SIMA.

Apprenticeship Certificates

The apprenticeship certificates of the following member firms were endorsed by the official seal of the Association, indicating that a course of instruction, approved by the Association, had been carried out.

R. B. Pullin & Co. Ltd. ...	1
Baird & Tatlock (London) Ltd.	4
Edwards High Vacuum Ltd. ...	1
W. F. Stanley & Co. Ltd. ...	1

The Hirst Research Centre

THE Wembley Research Laboratories of the General Electric Co. have been reorganised and to mark the change of policy it has been decided to re-name the Laboratories "The Hirst Research Centre" as a tribute to the founder of the G.E.C., the late Lord Hirst.

Autonomous research units, operating side by side and each sharing the same scientific and administrative services, will be set up. This will enable those of the seven groups and the subsidiaries of the Company that wish to do so to have research units under their own control, thus securing a closer integration of applied research and development than in the past.

Under the new scheme, two main research units, the Central Research Laboratories and the Telecommunications and Engineering Research Laboratories are planned, and other group research laboratories will follow. The Central Research Laboratories, under Mr. V. J. Francis, will be responsible for the majority of the more fundamental research programmes, and will provide specialised scientific and technical services to the whole of the Centre.

The Telecommunications and Engineering Research Laboratories, under Mr. R. J. Clayton, will do work on behalf of the Telecommunications and Engineering Groups of the company.

The two Laboratories will continue to act for groups which do not, for the time being, have their own research units.

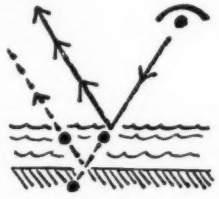
This evolution is a logical step following the formation at the beginning of the year of five new operating groups of G.E.C. The five—Domestic Equipment, Installation Equipment, Lighting and Heating, Osram and Radio and Television—joined the Telecommunications and Electronics Group and Engineering Group to make up seven complete units for production and sales.

Now, a closer association will be possible between the research units and the seven groups. The tighter coupling between applied research and development resulting from unified management will enable new products to be marketed more swiftly.

Infra-Red Heating

Infra-red heating is the name given to the method of using in industrial processes radiant heat from heaters specifically designed for that purpose. This differentiates it from methods employing both radiation and convection, as in furnaces, although the effect of the radiation is much the same in both cases.

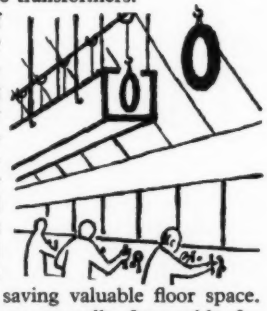
Radiant heat provides a higher rate of heat transfer to bodies not highly reflective than does convection, unless high-velocity forced convection is used. The rate of heating of a body depends upon the intensity of radiation on its surface, the proportion absorbed by the surface and, subsequently, on heat conduction. In heating very thin bodies, for example paint films, the radiation not reflected nor absorbed passes through and is in turn reflected or absorbed by the underlying material. This reflected heat is partly absorbed by the paint film "on the way back". Despite this effect it is an exaggeration to claim that infra-red "heats from the inside out" and it remains largely a surface heating effect except in a few special cases.



Infra-red heaters mainly use metal-sheathed elements in special reflectors, but infra-red lamps with internal reflectors are still used in special cases. Other types use silica-sheathed elements or quartz-sheathed lamps in reflectors. A wide range of heaters is available with simple mounting arrangements to enable heat to be applied quickly and effectively either in a production line or in some odd corner.

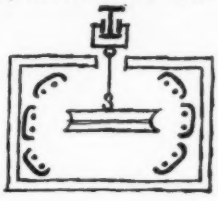
Control of the charge temperature is effected by regulating the heating time and power. In the case of a moving charge, this is done by adjusting the conveyor speed and the number of heaters in circuit, i.e., by adjusting the effective length of the oven. Some of the heaters may be controlled by energy regulators or adjustable transformers.

The advantages of infra-red heating over convection heating include reduced heating times, reduced floor space, lower installation costs, almost instant starting, ability to focus the heat, and flexibility in effective oven length. Infra-red ovens can often be mounted in the roof, saving valuable floor space. Infra-red heating is not generally favourable for heating large bodies of low heat conductivity.



Paint Stoving

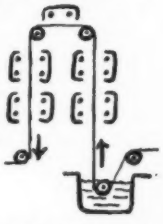
Not all paints are suited to infra-red radiation, but suitable paints are stoved quickly and often give a better finish. Synthetic enamels are the most suitable. Articles successfully stoved include motor car bodies, wheels and other accessories, refrigerator and washing machine cabinets, cylindrical drums and barrels, metal furniture, valve hand wheels, metal toys and a host of other articles. Lacquers and varnishes are being quickly and effectively stoved on jewellery, packing strips, tubes, films and similar products. Special infra-red lamp ovens stove synthetic finishes on wooden furniture and components. In all cases stoving times have been reduced very considerably.



Moisture Extraction

Sheathed element heaters are particularly useful for drying surface water films, their radiation being readily absorbed by water. High rates of drying are possible provided the water vapour can readily disperse. Drying of "contained" water can be effected provided the water can diffuse from the interior at a rate equalling the surface drying rate. With heat-sensitive materials sheathed element heaters may have to be arranged to move away from the material to avoid overheating if the conveyor stops, being interlocked with the conveyor for this purpose. Lamps are sometimes used instead for such materials because of their instantaneous cut-off.

Infra-red is widely used for drying coatings and inks on paper and textile products, bottle seals and labels, clayware and glazes, pigments on leather and many other products.



Plastic Heating

Infra-red heating is widely used in the plastics and allied industries. Typical applications are the preheating of plastic pellets and of sheets prior to moulding, curing of plastic and rubber sheets and belts, heat setting of nylon and similar fabrics, drying and curing of latex films on carpets and many others where a plastic forms the whole or part of the product.

The above are just a few examples of successful applications of infra-red. In many other processes infra-red heaters can often be fitted quickly and cheaply, to save time, labour and floor space and, therefore, money.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London W.C.2. Telephone: TEMple Bar 9434.

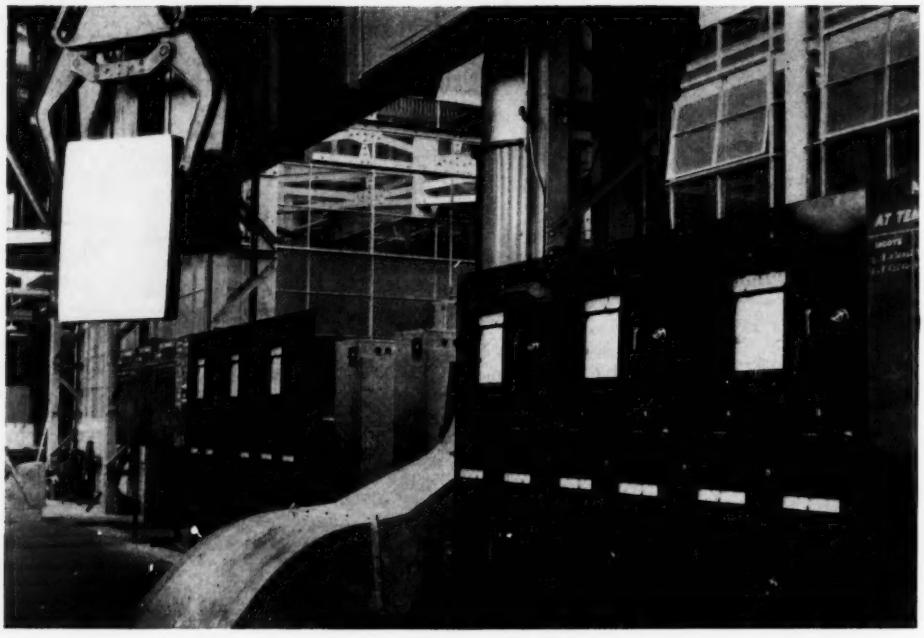
Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available — "Resistance Heating" is an example; "Induction and Dielectric Heating" is another.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

8131

CUT HERE

Circle **164** for further information



LEEDS NORTHRUP

Billet Production Control at Northern Aluminium Co. Ltd.

WE are indebted to the Northern Aluminium Co. Ltd. (Alcan G.B. Ltd.) for the above picture of part of the Leeds Northrup instrumentation controlling billet production at their Banbury works.

Furnace temperature/time is rigidly controlled and continuously recorded on the charts.

THE Leeds Northrup Speedomax, Type H, is doing this furnace control job in works all over the world. It is a compact instrument—only 11 x 11 x 12 in.—and lower in cost than any comparable instrument.

Send now for descriptive literature, or have a demonstration in your own works

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INSTRUMENT PRACTICE

SURVEY OF NEW INSTRUMENTS

ELECTRICAL · ELECTRONIC · MECHANICAL · NUCLEONIC · PNEUMATIC

V.bration Limit Controller

THE Type 1434 vibration limit controller has been designed by Dawe Instruments to provide continuous protection for large rotating machinery such as turbo-generators, motors, engines or pumps, against failures arising from excessive vibration.

Provision is made for operating an external warning lamp or bell, or to switch off the machine under supervision at any predetermined vibration level before serious damage or failure can occur. A direct reading meter is incorporated to show the actual vibration level and an output signal is provided for connection to a standard recording d.c. milliammeter so that a permanent record of the vibration level can be obtained.

This instrument is of great advantage in circumstances where the vibration level has to be kept within safe limits. The vibration pick-up, which is hermetically sealed in an inert gas, can be attached to a machine in dangerous or inaccessible locations at a considerable distance from the control unit and will give unimpaired operation under adverse conditions of high temperature and humidity.

The vibration limit controller, Type 1434, comprises a vibration pick-up, an integrating network, an amplifier, a meter calibrated to read displacement and alarm relay circuits.

The electronic unit includes an integrating network to convert the velocity response of the pick-up to a displacement signal which is amplified and rectified to obtain a meter reading proportional to the average vibration level. The meter is calibrated in peak values of displacement for a simple harmonic motion applied to the vibration pick-up.

The output signal is also compared with a pre-set bias level and fed to a trip valve with a heavy duty relay in its anode circuit. The bias can be adjusted so that the valve is triggered at any vibration level between 20% and 100% of full scale deflection of the meter. An internal calibration signal is available for setting up the alarm level. The signal is adjusted to simulate the maximum permissible vibration level and the bias is set to operate the relay at this level. Once the alarm circuit is tripped it remains operative until manually reset with the push-button on the front setting. However, to avoid operation by a momentary unrelated mechanical shock a delay network is incorporated. The delay time is such that the alarm is only operated when the duration of the excess vibration is maintained for about 7 seconds at 5% above the alarm level or about 3 seconds for 20% excess vibration.

The control unit is housed in a bench mounting cabinet but can readily be fitted to a control console or rack installation.

CONTROL UNIT

Sensitivity:
Four ranges are provided.
Type 1434A (British units) 0–0·001 in. 0–0·003 in. 0–0·010 and 0–0·030 in.
Type 1434B (Metric units) 0–0·03 mm, 0–0·1 mm, 0–0·3 mm and 0–1·0 mm.

Frequency range:
20–400 c/s (1,200–24,000 rev/min).

Set limit:
Vibration limit relay can be set to operate between 20% and 100% of meter deflection on each displacement range. Internal injection signal is available for setting the operating level.

Contacts rating:
5 A at 250 V a.c. non-inductive
1·2 A at 250 V d.c. non-inductive.

External recorder:
D.C. output proportional to the overall vibration level 1 mA at full scale meter deflection into nominal load resistance of 1,000 Ω.

Mains supply:
110 V and 200–250 V, 50–60 c/s, 40 W approx.

VIBRATION PICK-UP

Type:
Moving coil, nitrogen filled, hermetically sealed. Output voltage proportional to the displacement and frequency of vibration (integrating network incorporated in the amplifier unit to obtain output proportional to displacement only).

Circle **1** *for further details.*

Trimpot Subminiature Potentiometer

THE latest Bourns Trimpot, Model No. 224, is being produced at the Northampton works of Painton & Co. Ltd.

This 1·25 in. long wirewound potentiometer operates at 175°C and is sealed against humidity, liquids and potting compounds.

A self-locking 22-turn screwdriver adjustment with excellent shock, vibration and acceleration stability, and the precision wound element ensure the highest level of reliability. Power dissipation is 1 watt at 70°C and 0·5 watt at 125°C. Resistance value available up to 100 k ohms.

Three types of terminal configurations are available: insulated leads, solder-lugs and printed circuit pins.

Circle **2** *for further details.*

Illuminating Magnifier

THE Enbeeco "Master Inspector" employs two large diameter (6 in.) plano convex lenses which enable easy binocular vision on the part of operatives, thus reducing the effort of the accommodation and convergence of the eye, as with a magnifier with small diameter lens.

It has a flat and brightly illuminated field, good magnification and is substantially free from distortion.

There is no radiation of heat since the source of illumination is a cold cathode circular tube with a life of approximately 10,000 hours. It offers almost daylight, shadowfree illumination, which is of great advantage for colour determination.

There is stereoscopic, strain-free viewing. The magnifier is available from Newbold & Bulford Ltd., price £24 15s. 0d. net.

Circle **3** *for further details.*

"Universal" Multi-point Recorder

THIS version of the multi-point electronic strip chart recorder enables alternatives of 2, 3, 4, 6, 8, 10, 12, 16, 20 or 24 points to be measured and recorded on one instrument. It is produced by Honeywell Controls Ltd.

Known as the Universal ElectroniK multi-point recorder, it increases the scope of recording different numbers of variables on the same instrument. Range and compensation can also be altered.

The action consists of replacing print wheel-cum-indicator dial which is fixed by a thumb-tight nut; then replacing a shorting plug unit on a special input terminal board inside the instrument. The range of the instrument can be changed by slipping in new range resistor cards, and can be compensated for different types of measuring unit by slipping in a new input terminal board.

The Universal design can be supplied on any of Honeywell's non-control strip-chart recorders. This is to give an economical instrument for research work or process applications where the number of records being monitored changes frequently.

Circle **4** *for further details.*

Punched Paper Tape Reader

ENGLISH ELECTRIC are now manufacturing as standard equipment, at the Company's Data Processing and Control Systems Division at Kidsgrove, Staffordshire, a high-performance punched paper tape reader, originally designed for use with the DEUCE computer.

The reading speed is up to 1,000 characters per second, and the tape can be stopped from full speed after reading any character, without losing the next. It can be started and stopped to a maximum of 30 times per second. A simple adjustment is provided to accept tapes of standard widths with five, seven, or eight code holes, and tape may be used from any stock, subject to certain limitations on translucency.

Magazines are available for fitting to the machine to allow repetitive reading of a loop of tape up to 100 ft in length, or to accommodate up to 300 ft of free tape which may then be easily rewound from the trailing end. Magazines are easily interchangeable and any number can be supplied for use with a reader. A replaceable plugboard allows rearrangement or omission of the bits within a character as read from the tape. Switches are provided which allow the operator to select odd or even parity checks or no check, and which cause any "all ones" character to be ignored. The reader uses only transistor circuits; the sensing elements are phototransistors which are compensated for temperature variation.

Circle **5** *for further details.*

Frequency Checking Equipment

THIS equipment has been designed by Standard Telephones and Cables for the accurate measurement of frequencies in the 3,600-4,200 Mc/s band. It permits the frequencies of microwave radio relay equipment operating in this band to be set correctly, e.g., the transmitter output frequency and the local oscillator frequency.

It may be used with 4,000 Mc/s radio systems utilising the C.C.I.R. or the 40/70 (N. American) frequency allocation plans. The equipment consists of an s.h.f. signal mixer operating in conjunction with an external heterodyne frequency meter.

Circle **6** *for further details.*

Oscillator

STANDARD TELEPHONES AND CABLES' oscillator, Type 74195-A, is a variable frequency oscillator of high precision which is intended for general use at frequencies up to 20 Mc/s. The circuit arrangements are such that a frequency accuracy approaching that of a fixed-frequency crystal-controlled oscillator is achieved over the whole of the frequency range, and is adequate for injecting signals into the gaps between traffic on multi-circuit telephone transmission systems. A tracking signal can be sent from the oscillator to enable the associated 74194-A selective level measuring set to be kept automatically in step with the oscillator output frequency.

The oscillator is mains-operated and is housed in a transportable metal box.

Circle **7** *for further details.*

Silver Star Miniature Capacitors

JOHNSON MATTHEY & CO. LIMITED announce the development of two new Silver Star capacitors, Types A15E and A25E, which are square in section, of very small size and designed specifically for transistorised printed circuitry. The components are encapsulated in synthetic resin.

Type A15E is $\frac{1}{4}$ in. square $\times$ $\frac{1}{2}$ in. long and has a capacitance range of 33-6,000 μμF (minimum tolerance $\pm 2\%$, or ± 2 μμF below 100 μμF). A25E has the same section but is 1 in. long and has a capacitance range of 6,000-20,000 μμF (minimum tolerance $\pm 1\%$). Any capacitance value within these ranges can be supplied. Both types are rated at 50 volts peak working.

Although the leads emerge axially they can be readily adjusted to fit 0·1 in. or 0·2 in. module printed circuit boards. The square section permits the cementing of the capacitors to the printed circuit boards if acceleration forces are high.

The Silver Star fired construction is used to ensure maximum long-term stability, while strict control over the mica and manufacturing processes ensures a consistently high insulation resistance and low power factor.

Circle **8** *for further details.*

Non-Contact Thickness Gauge

THE AMERICAN DAYSTROM CO. recently established a U.K. technical sales and service facility at Gloucester, known as Daystrom Ltd. Now available through this company is an X-ray gauge which can be used primarily with rolled or extruded products.

The guage is known as the XactRAY and consists of three basic elements, an X-ray generator, which directs controlled beams of X-rays through the material being measured, the X-ray incident unit or pick-up which converts the transmitted electro-magnetic energy into an electrical signal, and an electronic console, which computes and converts the signal into meter indications. Dimensional changes are displayed as a deviation from the pre-set nominal thickness on an indicator calibrated in any unit of density or thickness.

A signal proportional to thickness deviation is available to operate automatic thickness control, data logging devices, and strip chart recorders for permanent records, or marking of off-gauge material.

The X-ray generator and pick-up unit are mounted on opposite sides of the material which is being measured and in installations where space is limited, the X-ray generator and pick-up unit can be permanently mounted in the production machine.

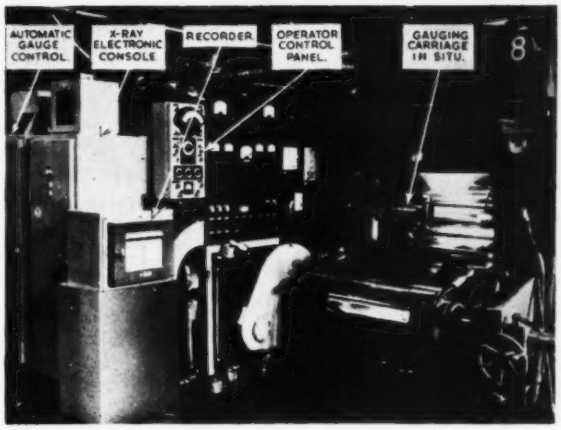
Both X-ray generator and pick-up unit have been designed to operate under severe mill conditions and are sealed against oil, water and steam. In situations where they are liable to mechanical damage, special armoured gauges are available.

The electronic console is preferably located in the motor room within 100 ft of the X-ray source. Positive filtered air pressure is, however, maintained within the cubicle to ensure reliability in locations where airborne dust and dirt are prevalent. All electronic components are mounted on a special hinged modular chassis to permit inspection during operation.

A patented feature of the XactRAY is a device for inserting metal standards into the X-ray beam for calibration purposes. These standards are enclosed in a sealed chamber directly above the X-ray source and are inserted into the beam by rotary solenoids. The system enables an operator at a remote position to select the exact thickness to be measured in increments as small as 0·0001 in. Normally, the XactRAY can be set to a new thickness range in less than 10 seconds, including time for recalibration. Where materials of different densities are to be gauged, a multi-position selection switch, which automatically compensates for any variation of density, is provided.

Five models of the guage give a range from 0·00035 in. for aluminium foil to 2 in. steel plate; any one model has a thickness range of up to 200 : 1 (a 60 kV X-ray generator is suitable for 0·010–2·00 in. of aluminium). Accuracy is better than ±1% of the thickness being measured and to special order this figure can be improved to 0·5%. Stability is guaranteed for at least 8 hours.

All thickness setting dials, switches, signal lamps and the thickness deviation meter are mounted on the electronic console. Where it is desirable to have the control separate from the console, an operator's control panel can be provided to enable all functions of the gauge to be instantly controlled from a remote position up to 200 ft from the main console.



XactRAY thickness gauge in use

No special radiological screening is stated to be necessary.

Circle **9** *for further details.*

Nuclear Detection

PHOTOELECTRONICS (M.O.M.) LTD. have produced the "Amatron" portable radiation monitor to an approved Harwell design. The unit is suitable for teaching, demonstrating and showing the presence of beta/gamma emitting elements. Low energy beta radiation can be monitored by changing the G.M. tube. Visual and audible means are provided for indicating contamination by use of a large neon and 2½ in. loudspeaker. Provision is also made for using an external meter (0–500 microamp d.c.) or connecting up to an amplified loudspeaker system. The G.M. probe is separate and attached to the main unit by 6 ft of coaxial cable. The monitor is either battery or mains operated.

Radiation from an external source ionises the gas in the G.M. tube which gives out a pulse large enough to trigger the neon circuit. The neon in turn supplies a pulse which gives an audible signal in the loudspeaker for each count. When the meter is inserted into the circuit by means of the jack plug, the current through the neon circuit is maintained and since this is proportional to count rate, the scale of the meter can be suitably calibrated.

The probe consists of a Geiger Müller tube fitted into an octal valve base and contained in a protective sheath. Also contained in the sheath is a condenser and resistor fitted in series with the coaxial cable. To facilitate replacement, the tube and components are fitted to a base piece which can be completely withdrawn from the sheath. The probe is normally stored in a clip fixed on the side of the main case.

Contained in the main unit is the neon indicator which projects from the front by approximately ⅛ in. in order to give good all-round visibility and is protected with a metal guard; a loudspeaker, with speaker transformer; a jack socket for meter connection,

battery or mains unit (whichever is required) and associated components.

The price is £27 10s. 0d. (plus batteries) and delivery is 3 to 4 weeks.

Circle **10** *for further details.*

"Pulsimitor"

ELECTRONIC MACHINE CO. LTD. have developed a capacity operated switch that will give a pulse output against a very small change in input capacity and due to the nature of the circuitry, long term and reliable operation can be obtained for changes of the order of 0·07 pF. It is known as the Pulsimitor. The output from the sensing valve is differentiated and coupled to the switching valve which is normally biassed to cut-off. With a sudden capacity change of 0·07 pF a pulse appears at the switching valve grid of sufficient amplitude to make the valve conduct and when it is conducting it will give a voltage of 100 across a load of 10,000 ohms in the anode circuit. Thus a sudden change in input capacity, such as will be encountered in sensing moving objects, will give a switch operation, and any slow change in capacity such as would be encountered in drift, will not be fast enough to produce a pulse. For this reason the instrument can be reliably operated on a very small capacity change which would be impractical with more conventional capacity operated counters. Speed of operation is up to 12,000 per minute and down to 5 per minute.

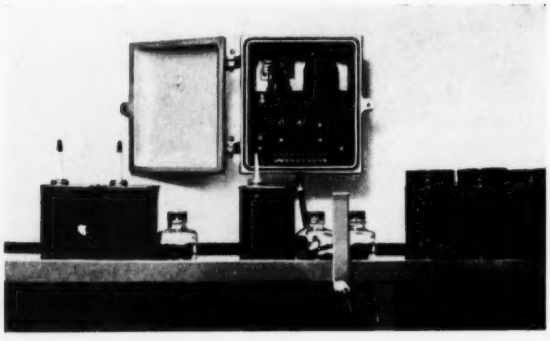
The Pulsimitor will count or sense random shaped containers and objects made from such widely different materials as plastics, metal, glass and alloys.

If this Pulsimitor is used for counting it is necessary to use a high-speed d.c. counter with a coil resistance of 10,000 ohms, as although it will operate down to a relatively low speed (5 pulses/min nominal), the pulse width is short, due to the nature of the principles involved.

The switch unit itself is housed in a robust cast aluminium case to withstand heavy industrial use and the chassis is so designed that by the loosening of four screws it may be easily withdrawn from its case without affecting in any way the installation wiring, thus permitting easy maintenance and quick change over in emergency.

Circle **11** *for further details.*

Capacity operated "Pulsimitor" switch



IBM 3000 Accounting System

THE IBM 3000 accounting machine has a basic speed of 90 cards a minute. It consists basically of three machines: a punch/verifier, on which information is recorded in punched card form and then checked; a card sorter, which can sort cards into alphabetic or numerical sequence; an accounting machine, which combines several functions in one machine, including calculating, punching and printing.

The punched card used with the system, though small, still contains the full 80 columns of information that are standard in full-scale machines, and IBM research has brought about the first machine in which the ability to calculate, print and punch is combined in a single processing unit.

The new system is designed for the thousands of users for whom conventional punched card equipment is not an economic proposition.

Typical operations of the 3000 will be invoicing, stock control, payroll, sales analysis, and accounts receivable. Ready-programmed applications are available with the machines, based on extensive studies of typical business problems, and these solutions can be adopted as they stand or modified to suit the special requirements of the individual user.

The IBM 3050, which is an addition to the IBM 3000 accounting system, prints in clear lettering along the top of the card the information contained in punched hole form. It can read and interpret both alphabetic and numeric information at a speed of 45 cards a minute.

Circle **12** *for further details.*

High Voltage Stabilised Power Supply

DESIGNED for use with electron tubes requiring voltages in the range 1 to 2·25 kV, the Philips PP.4485 stabilised power supply is recommended for klystrons producing millimeter waves, e.g., Philips 8 mm klystron Type 55335.

The following electrode supplies are available:

(a) Cavity 1,000 to 2,250 volts at 0 to 30 mA; (0 to 50 mA at 1,000 volts)
(b) Reflector 0 to −550 volts (1 mA max)
(c) Grid 0 to −300 volts
(d) Heater 6 to 7 volts a.c.

Continuous indication of cavity voltage and current, together with reflector and heater voltages, is possible from the four built-in meters.

Provision is made for external modulation of reflector voltage and a safety device is incorporated to protect the klystron from any accidental change in operating conditions.

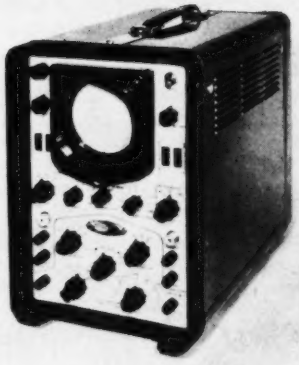
The sole distributors of the instrument in the U.K. are Research and Control Instruments Ltd.

Circle **13** *for further details.*

Cossorscope

A NEW portable double beam oscilloscope by Cossor Instruments Ltd., the Cossorscope, Model 2000, employs a 4-in. cathode ray tube in which the entire screen area can be utilised. Independent focus and brightness controls are provided for each beam, together with a pre-set astigmatism control.

The bandwidth of the two identical vertical deflection



Frequency and time measuring equipment

◀ *Cossorscope Model* 2000

Square-wave unit, Type SW98 ▶

amplifiers is d.c. to 5 Mc/s (−30%) giving an output deflection of not less than 6 cm. Calibrated sensitivity is from 100 mV/cm to 100 V/cm in steps of 1, 3 and 10, variable by a ratio of 3 : 1 on each range. In addition two identical preamplifiers extend the maximum sensitivity to 1 mV/cm, within the bandwidth 5 c/s to 0·5 Mc/s.

Time base speeds range from 3 sec/cm to 1 μs/cm, in 21 calibrated steps. Sweep expansion is variable up to a calibrated maximum of ×10, and the bright-up pulse is d.c. coupled to the cathode ray tube. Maximum trigger sensitivity is 0·1 V external and 3 mm internal signal, and a trigger level control permits manual triggering from any point on a waveform. Automatic synchronising facilities are also provided.

In the sweep delay circuit four overlapping ranges provide a delay time variable from 1 μs to several milliseconds.

Other triggering facilities include a built-in T.V. sync separator which enables the sweep to be locked on a line or frame pulse in a composite video waveform.

The d.c. coupled horizontal amplifier has a sensitivity variable from 200 mV/cm to 2 V/cm, d.c. to 0·5 Mc/s (−30%).

Among other facilities offered by this oscilloscope are high frequency, 20 Mc/s time markers synchronised to the time-base for accurate measurement of pulse rise times, and an illuminated graticule with variable control. The cathode ray tube Y plates are directly accessible, and due to its "unit" construction, Cossorscope, Model 2000, is easily serviced.

The list price is approximately £129.

Circle **14** *for further details.*

Frequency and Tune Measuring Equipment

VENNER ELECTRONICS LTD. have developed a new frequency and time measuring equipment, Type TSA.3336, which has provision for measurement of frequency up to 1·1 Mc/s, inverse frequency (period), simple counting and time intervals in microsecond or larger units. In addition the outputs of the oven-controlled megacycle crystal oscillator and the decade divider chain are made available for external use as "clock" pulses. The instrument may be reset remotely, or locally by manual or automatic operation.

The TSA.3336 includes transistor plug-in circuit modules from the Venner range and can be supplied with outputs to operate a printer or a reperforator.

The TSA.3336 measures $14\frac{1}{2} \times 12\frac{3}{4}$ and $8\frac{1}{2}$ in. high and weighs 26 lb. It can be operated from 100–125 V, 200–250 V, 50 c/s mains or 12 V d.c.

The price in the U.K. is £338.

Circle **15** *for further details.*

Square-wave Unit

SQUARE-WAVE UNIT, Type SW98, manufactured by Feedback Ltd., provides a square-wave driving signal for repetitive analogues.

A square-wave at mains frequency is provided, and the unit also generates square-waves from externally applied sine-waves over the frequency range 50 c/s to 10 kc/s. The rise time is about 2 micro-seconds for any operating frequency and a mark-space ratio trim is provided to enable an exact 1 : 1 ratio to be obtained.

The minimum external signal for satisfactory operation is 2 volts peak, and the output is continuously adjustable from 0–50 volts peak-to-peak independently of the input amplitude.

A tuned circuit has been incorporated to generate a calibration oscillation for time measurement on an oscilloscope trace for use with repetitive analogues. The calibration frequency is 2·5 kc/s, and the oscillation train may be switched to occur during either the positive or negative half of the square-wave.

This unit is one of a range comprising d.c. amplifiers, transfer function units, servo test waveform generator, and stabilised d.c. power supplies.

The price is £25.

Circle **16** *for further details.*

Snap-around Volt-Ammeters

THE Amprobe Junior is an inexpensive, snap-around, volt-amp tester that measures current instantly without shutdowns or ammeter connections. Accuracy of both voltage and current ranges is ±3% of full scale. Readings are obtained on a full size 1·8 in. calibrated scale.

The instrument is available in 0–300/600 volt models in current ranges of either 0–25, 0–50 and 0–100 A a.c.

Other snap-around volt-ammeters in the broad Pyramid line are the Amprobe RS-3 which measures

current via five scales; 0–15/40/100/300 and voltage via 3 scales; 0–150/300/600 and one ohmmeter range with a 20 ohm centre; the RS-1 which measures current via four scales: 0–5/15/40/100 and voltage via two scales: 0–150/600; the TM Kit Model 33 consisting of an Amprobe RS-3, Deca-tran and Energizer; and the TM Kit Model 11 which consists of the Amprobe RS-1, Decatran and Energizer.

The Amprobe range of instruments is manufactured by the Pyramid Instrument Corp.

Circle **17** *for further details.*

U.H.F. Beam Power Tubes

RCA-7842, -7843 and -7844 are three new, small conduction-cooled u.h.f. beam power tubes for missiles, satellites, or mobile equipment where the use of air cooling may not be practical.

The three types—may be used as an r.f. power amplifier, oscillator, frequency multiplier, a.f. power amplifier, or modulator. They have a maximum c.w. plate input of 180 watts and are designed for operation with full ratings at frequencies from 960 to 1215 Mc/s, and are useful up to 2000 Mc/s and above.

7844—6·3 volt/2·1 ampere heater, oxide-coated-type cathode

7843—Similar to 7844, with 26·5 volt/0·52 ampere heater

7842—Similar to 7844, with 6·3 volt/3 ampere heater, matrix-type cathode. The 7842 is designed especially for applications where dependable performance under severe shock and vibration is essential. The 7842 withstands vibrational accelerations of 10*g* and shock impact as great as 500*g*.

Conduction cooling of these new types is enhanced by the use of an integral aluminium-alloy conduction cylinder. Also featured in these Cermolox tubes are coaxial-electrode structure with unitised electrode construction, low-loss ceramic bushings, high-power sensitivity, and high efficiency.

These tubes are available through RCA Great Britain Ltd.

Circle **18** *for further details.*

Bench Instrument with New Movement

THE 3 in. moving-coil school bench instrument by Crompton Parkinson now has an entirely new movement.

Electrically the old and new movements are interchangeable. Coil resistance, current at full scale, and volt drop remain unaltered, but the instrument is now even more robust, reliable and trouble-free than before. And the student can see more easily what's going on inside.

The difference is in the magnet system. The normal method of construction, in which the magnet and pole shoes are ground flat and then clamped together, inevitably leaves minute airgaps at the interface. In the new system a high-performance magnet alloy in powder form, and some soft iron powder for the pole shoes, are pre-formed and compressed in a die. In the subsequent sintering process, magnet and pole shoes become alloyed together at the interface to form a single unit of such efficiency that it can be made small enough to be placed within the moving coil—and still provide sufficient flux to give high sensitivity with good gap clearances. The outer annular ring of sintered soft iron completes the magnetic circuit and gives particularly good screening.

A wall chart describing the new movement and its operating principles is available from the manufacturers free of charge.

Circle **19** *for further details.*

Portable Hardness Tester

SMITHS INDUSTRIAL DIVISION have become sole U.K. distributors of a British invention—a portable hardness tester. This hardness tester is the only portable instrument of its type, embracing all recognised hardness value scales—V.P.N., Brinell, and Rockwell "C". It covers full B.S.I.869 specification range of hardness values.

Its weight is only 3 lb.

A bench-type version is also available; weighing only 28 lb, it can be used as a fixture or can easily be transported from one department of a works to another.

The action of the tester is comparable to the Rockwell principle. Grips on either side of the body are depressed by the ball of the operator's thumbs, this action lowering a diamond indentor from its otherwise retracted position and bringing it into contact with the material under test. Further depression causes the diamond point to penetrate (to a maximum of 0·005 in.), and during transmission of this vertical movement to linear movement of the pointer, the former is magnified in the ratio of 1,200 : 1.

Hardness scales on the large, safety-glass protected dial are in distinctive colours for easy reading. While sturdily constructed to protect its sensitive mechanism, the instrument is nevertheless light and easy to handle.

The hardness tester was invented and developed by J. O. Deakin and Co. Ltd., Tavistock, Devon.

Circle **20** *for further details.*

Plug-in Units for General Purpose Cossorscope 1076

A 6 cm vertical display, a d.c. to 60 Mc/s bandwidth at 50 mV/cm and a range of plug-in units for use on both X and Y channels are among the features offered by the general purpose Cossorscope, Model 1076, for which five new plug-in units were shown for the first time at the recent Physical Society Exhibition.

The basic oscilloscope comprises a 5 inch precision cathode ray tube, X and Y amplifiers, time base generator and power supplies which are adequately stabilised against mains input variations and varying load requirements of the different plug-in units.

There are intensity modulation time markers at both 50 Mc/s and 500 Mc/s which are automatically locked to the trace. In particular, the 500 Mc/s pips ensure accurate measurement of very fast rise times.

The new range of units includes a precision delayed trigger unit, Type 1082. This provides the user with two independent sweep generators, 'A' and 'B', either of which may present the cathode ray tube display. Sweep 'A' may be delayed by sweep 'B' over the range 2 μs to 10 seconds, whilst sweep 'B' can be brightened by sweep 'A' to indicate the time relation between the delayed sweep and the original trigger. Provision is

made to ensure a jitter-free trace even if the signal to be displayed is jittering relative to the trigger pulse.

For applications where less comprehensive delay facilities are required, delayed trigger unit, Type 1083, is available. Four ranges of sweep delay are controlled by a calibrated ten turn potentiometer, and a very high order of stability of delay is achieved.

Although the basic oscilloscope embodies a single beam cathode ray tube, two independent phenomena can be displayed by the dual-channel preamplifier, Type 1085. With this unit, each channel may be presented on alternate sweeps, presented singly, or in algebraic sum. Alternatively the two can be switched at a frequency of 100 kc/s for examination of low frequency signals. Bandwidth of both channels is d.c. to 40 Mc/s.

A differential preamplifier for work requiring d.c. coupling at 1 mV/cm and bandwidth up to 1 Mc/s, plug-in unit, Type 1080, features a low drift rate, constant bandwidth, calibrated attenuator and a high rejection ratio to in-phase signals. By careful adjustment of the panel balance controls a rejection ratio of 10,000 : 1 to in-phase signals may be achieved up to 50 kc/s.

Also included in the new range are Type 1081, a 3 c/s to 40 Mc/s, 5 mV/cm, preamplifier, and skeleton units with which users can construct circuitry suited to their own special requirements. Thus by appropriate choice of plug-in units, Model 1076 affords applications to nucleonics, communications, automation, semi-conductors and research and development in many other industries.

The list price, including two basic plug-in units (Types 1078 and 1079), is £650.

Circle **21** *for further details.*

Electromagnetic Vibrators

WITH the new design of magnetic vibrators from Magco Ltd., the bottom unit, which carries the armature, is comparatively light whilst the upper, moving unit, consists of a casting on which are carried the laminations and coil.

For example, with an original type vibrator weighing 100 lb, the moving top unit weighed 33 lb whilst, with the new conception, it would weigh 66 lb. In effect then, it is equivalent to turning the vibrator upside down, thus the ultimate user is presented with a vibrator of higher efficiency than before and tooling-up for what now becomes a repetitively produced article has meant a considerable saving in manufacturing costs.

These Magco electromagnetic vibrators have many uses, the most common of which is where a difficult or damp material will not flow freely forward out of a hopper.

A second example is where it is desired to increase the throughput of a chute set at an angle down which material normally flows or to handle a material of finer grade. A complete range of sizes are available, suitable for the smallest pharmaceutical packaging machines to bunkers holding hundreds of tons of run-of-mine ore or coal.

In the case of the smaller vibrator units they operate twice per cycle thus giving 6,000 vibrations per minute on a 50 cycle supply or 7,200 per minute on a 60 cycle supply. In the case of the larger models they operate on a half wave system, giving 3,000 vibrations per minute on a 50 cycle supply and 3,600 on a 60 cycle supply. Amplitude at these lower frequencies is much higher thus resulting in a more efficient vibrator.

Prices range from £10 0s. 0d. for the smallest unit up to £80 0s. 0d. for the largest unit.

Circle **22** *for further details.*

Solenoid Valves with Time-lag Device

DANFOSS have recently extended their range of solenoid valves to include two types with time-lag device.

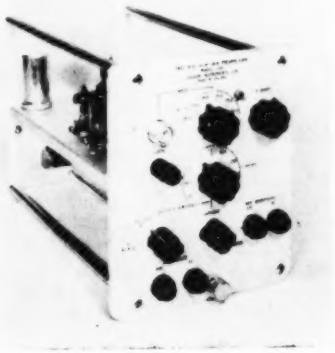
The valves differ from Danfoss' corresponding sizes of standard solenoid valves, Type EVJ and Type EVJD, only in the design of the coil. For these new valves a built-in NTC resistance is connected in series with the coil winding.

The result thereof is that the valve will not open until a certain time after the circuit has been closed, corresponding to the time it takes to heat the resistor so that its resistance has dropped sufficiently to enable the current to open the valve.

Solenoid valves with time-lag can be used to advantage in oil-burning plants where a delay in the flow of oil to the nozzle is desirable.

They allow the blower to reach its full speed of rotation before the atomised fuel is introduced, and thus ensure that the volume of air required for complete combustion is available at the moment of starting.

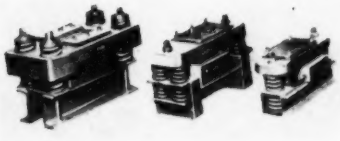
In thermostatically-controlled gas installation with hot spot ignition, it is possible to delay the supply of gas to such an extent that the filament is allowed to grow sufficiently hot to secure ignition, and the fairly

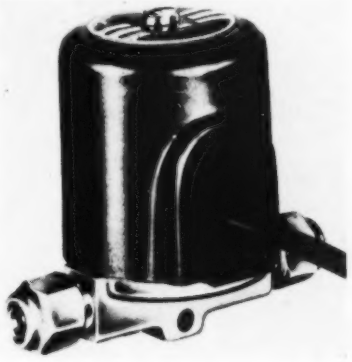


◀ *Plug-in unit, Type* 1081, *for general purpose Cossorscope*

Solenoid valve with time-lag device ▶

Electromagnetic vibrators





common small explosions at the moment of ignition are thereby avoided.

The valves can be used wherever a brief delay of the admission of a liquid or a gas is required.

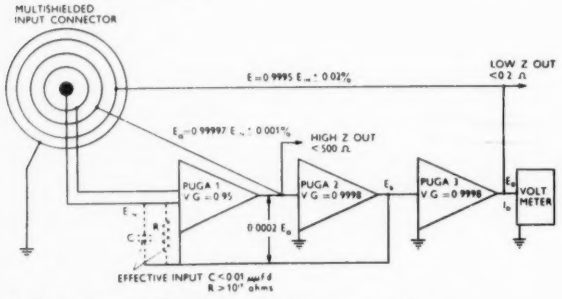
Circle **23** *for further details.*

Electrosensor Voltmeter

THE Model 301E Electrosensor voltmeter is a precision unity gain follower-amplifier with a d.c. following accuracy of 0·001% and a current sensitivity of 10^{-18}amp. The effective input resistance is greater than 10^{17} ohms and the input capacitance less than 0·01 μμF, so that the response time is negligible. Low and high impedance output terminals are provided of less than 0·2 ohms and 500 ohms respectively.

The instrument is basically a sensory device allowing direct current measurements to be made without changing the state of the measured elements.

An output meter is built in to provide a display accuracy of 1%. A switch selects eleven calibrated ranges with full scale values from ±1 volt up to ±250 V d.c. or 500 V peak-to-peak for low frequency a.c. Frequencies up to 1 kc/s can be accepted at low amplitudes from a low impedance source. The meter switching does not affect the input resistance, the output from the terminals or the gain of the individual amplifiers. After warming up, the drift is less than 0·001% of full scale voltage.


MULTISHIELDED INPUT CONNECTOR
LOW Z OUT <0·2 Ω
HIGH Z OUT <500 Ω
PUGA 1 V G = 0·95
PUGA 2 V G = 0·9998
PUGA 3 V G = 0·9998
VOLT METER
0·0002 Eb
EFFECTIVE INPUT C < 0·01 μμF R > 10¹⁷ ohms

Basic system of the Halex electrosensor voltmeter

The first amplifier PUGA1 is an electrometer which is isolated, self-powered and screened by its own earth from the rest of the system. This amplifier floats on the output of a second complete unity gain amplifier PUGA2 which becomes the relative earth plane for the first amplifier. The screen around PUGA2 also surrounds both PUGA1 and its screen. PUGA2 is also connected to the third amplifier PUGA3 which has an output impedance of less than 0·2 ohms. A second high impedance output of about 500 ohms is provided from another terminal at the output of PUGA1.

The actual input resistance of PUGA1 is 10^{14} ohms with an input capacitance of 10 μμF. The effective input impedance is raised in the following manner: the overall input impedance of the system is seen by an external source to be E_{in}/E_{out}. E_{in} is essentially the same as E_a and E_b since the amplifiers are accurate followers, but the input current I_{in} is substantially reduced because the voltage across R and C is 0·0002 $Ea_{0·95}$. Hence the new input impedance is approximately $5{,}000 \times 10^{14} = 5 \times 10^{17}$ ohms and the input capacitance is 0·002 μμF.

The instrument is manufactured by Halex Inc., U.S.A., and is available in this country through Scientific Furnishings Ltd.

Circle **24** *for further details.*

Teflon Terminal for Thicker-Chassis Mounting

FOR secure mounting in thicker chassis, Sealectro has brought out Type RFT-SM-2 TUR-C4 in its "Press-Fit" Teflon terminal line. This new type complements the reverse-turret feed-through terminals, with a longer Teflon body, for installation in chassis up to 0·125 in. thick.

Circle **25** *for further details.*

Sound Spectrometer

THE Advance sound spectrometer is a stable, light-weight instrument with its own battery power supply, and completely self-contained. With the built-in octave band filters, rapid analysis of noises having complex spectra is possible. It can also be used with a suitable vibration pick-up for vibration analysis in the audio frequency range. The Advance Type SPM.1 is particularly suited for noise measurements of aircraft, vehicles, machinery, and for the analysis of office noise, where the speech interference level is a significant factor.

The sound spectrometer Type SPM.1 consists of a very small crystal microphone; a six-stage amplifier, stabilised by heavy negative feedback; 8 bandpass filters, which can be switched in at choice and a moving-coil meter with a dB scale. An attenuator is built in with 5 steps of 10 dB covering a range of 30–80 dB, with an additional attenuator of 3 steps of 20 dB covering a range of 0–60 dB. Including the meter reading the total range of the apparatus is from 20 dB to 150 dB. Sounds with frequencies in the range from 20–12,000 c/s can be measured and, with the aid of the built-in filter, analysed into octave bands. The condition of the built-in batteries can be tested with the moving-coil meter.

Specification

Sound pressure level range:
From 20–150 dB above the standard sound pressure reference level of 2×10^{-4} microbar $= 2 \times 10^{-5}$ N/m² $= 2 \times 10^{-4}$ dyne/cm.²

Frequency characteristic:

One approximately linear frequency range (A.S.A/C) from	20–12,000 c/s (above 80 phons)
One range weighted DIN2 (A.S.A/A)	20–12,000 c/s 30–60 phons
One range weighted DIN1 (A.S.A/B)	20–12,000 c/s 60–80 phons
A low pass band filter from	20–90 c/s
An octave filter from ...	90–175 c/s
An octave filter from ...	175–350 c/s
An octave filter from ...	350–700 c/s
An octave filter from ...	700–1,400 c/s
An octave filter from ...	1,400–2,800 c/s
An octave filter from ...	2,800–5,600 c/s
A high pass bandfilter from	5,600–12,000 c/s

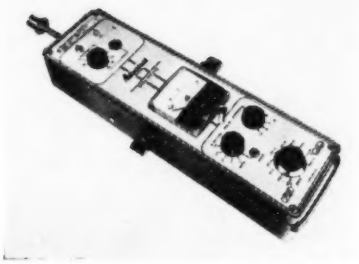
Except for the lowest octave filter about 30 dB attenuation is obtained at one half the lower nominal cut-off frequency and twice the upper nominal cut-off frequency.

Approx. 50 dB attenuation is obtained at one-fourth the lower nominal cut-off frequency and at four times the upper nominal cut-off frequency.

For the lowest octave filter these figures are somewhat less.

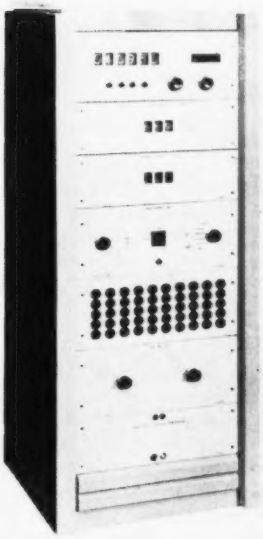
The 90 c/s low-pass filter has 40 dB attenuation at 450 c/s.

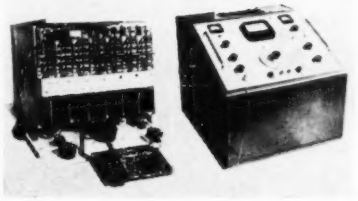
The 5,600 c/s high-pass filter has at least 40 dB attenuation at 1,200 c/s.



Sound spectrometer

Transistorised data logger/alarm scanner





Electronic spectrum analyser

Accuracy

When the amplifier sensitivity is standardised, the absolute accuracy of sound level measurement is in accordance with the A.S.A. standards.

Microphone

The non-directional microphone is of Rochelle-salt-crystal-diaphragm type which is heavily damped by a special air-cushion system.

The diameter of the microphone is 1·2 inches and it can be pulled out of the cabinet of the sound spectrometer to avoid disturbance of the sound field.

Input

An external microphone, vibration pick-up or other device can be connected to the apparatus. Voltages from 3 μV to 8 V approximately can be measured. Input impedance 10 ohms.

Output

An output jack is provided for aural monitoring of the filtered signal by means of a special headphone or for the connection of a level-recorder, oscillograph and other devices. About 1·5 volts across 4,000 ohms is available at the output jack.

Dimensions

17 in. (length × 4·75 in. (width) × 3·2 in. (height)
(43 cm × 12 cm × 8 cm)

Batteries

2 batteries 1·5 V Ever Ready D19, dimensions 27 × 100 mm
1 battery 45 V Every Ready B108, dimensions 100 × 67 × 25 mm

Weight

9 lb (4·3 kg).

Price

£210 0s. 0d. net.

Circle **26** *for further details.*

Low Frequency Spectrum Analyser

A NEW electronic spectrum analyser capable of analysing waveforms of vibrations, strains and resonances as low in frequency as one cycle in three seconds is being produced by Fenlow Electronics Ltd., Surrey.

The equipment has been developed in the first place for use with aircraft structures, but it has research and design study applications in almost every scientific and technological field. In the motor industry and on railways, for instance, it would help in the design of suspensions to give improved performance. In shipbuilding and civil engineering the vibration in large structures can be studied before they are built, thus saving valuable time and avoiding expensive modifications.

The instrument has a frequency range from $\frac{1}{3}$ c/s to 1,000 c/s and the output gives a true indication of the power density in the frequencies under observation. It is fully transistorised and easily transportable. Analogue computer techniques are used, and monitor points enable six operational amplifiers in the instrument to be used for a variety of other purposes. For instance, they may be used to simulate equations for a mechanical system, and for medical use it may be used to simulate physiological servo loops.

The price of the instrument alone is about £1,000 and in addition it can be supplied with recording equipment and other auxiliaries to suit the particular conditions involved.

Circle **27** *for further details.*

Transistorised Data Logger/Alarm Scanner

THE transistorised data logger/alarm scanner, Type, 300, has been designed and built by Microcell Ltd. The equipment is unusual in that parts made by other suppliers are used in the system thus allowing equipment with a difficult and tight specification to be built in a much shorter time. Compromises, in order to meet a customer's requirements, are thus reduced to a minimum.

No. of input channels:—By units of 5 up to 1,000.

Input commutation:—By individual dry reed sealed relays with gold-plated contacts. 5μV switching noise. Relays guaranteed for 10^9 operations.

No. of contacts on each commutator relay:—6 as standard. 12 available by additional dry reed relay.

Scanning Rate:—150 channel/second max. 100, 50, 25, 10, 5, 2 and 1 per second by switched selection. Individual point selection and single scan facilities also provided.

Input Sensitivity:—10 millivolts (9·99 V full scale) without amplifier. 10 microvolts (9·99 mV full scale) with

data amplifier. Automatic pre-set span selection called up by commutator relays, via span selector pin boards.

Linearisation:—By passive networks when differential input amplifier is used. By feedback around the amplifier with single ended amplifier. Networks called up by commutator relays.

Analogue/Digital Convertor:—Mullard, Type L.281, (0·1%) as standard. Non-linear system, 4 decade, 0·01% convertors available if required.

Span and Zero Suppression:—Both adjustable by independent pin boards.

Alarm Settings:—High or low by decade switches in groups or individual. By pin board where more than 10 alarm levels required.

Alarm Groups:—Allocation of specific channels to alarm groups by pin boards.

Alarm Comparator:—Digital, number for number comparison on output of analogue/digital convertor.

Alarm Memory:—Transistorised bi-stables and relays.

Annunciator Panel:—Electro-luminescent strips in groups to suit number of input channels. Auxiliary relay contacts available for audible alarms and/or control purposes.

Digital Store:—Digital display retains measured signal level on selection channel, changing once per scan.

Digital Clock:—Hours, minutes and second indicator. Output lines on each decade for feeding to the output printing device. Time intervals for calling up logging periods or control functions—variable by decade switches.

Output Devices:—Strip printer. Electric typewriter. Paper tape. Punched card. Magnetic tape.

Overall System Accuracy:—Depends upon data amplifier and analogue/digital converter used.

Standard—0·2% Special—0·05%

Circle **28** *for further details.*

Veriflux Amplifier

A NEW amplifier for use with the Altoflux flowmeter has recently been introduced by Alto Instruments (Great Britain) Ltd. known as the Veriflux amplifier. There is a facility to feed the output directly into any proprietary secondary instrument such as potentiometric and deflection types of electronic transducers. There are two outputs of 0–15 mA and 0–50 mV. Printed circuit construction is used throughout for reliability and ease of maintenance and this method also enables the price to be kept low. The Veriflux is, in fact, cheaper than the present Altoflux amplifier.

An indicating milliammeter to facilitate setting-up and check-calibration is incorporated. The standard amplifier is suitable for three flow ranges and the instrument is completely interchangeable with the present Altoflux amplifier.

Circle **29** *for further details.*

Twin Power Pentode

RCA is pleased to offer to equipment manufacturers the 6939—a twin power pentode of the 9-pin miniature type. This tube, which has built-in neutralising capacitors, is intended especially for use as a push-pull r.f.-power-amplifier tube or as a frequency-multiplier tube in communications equipment operating at frequencies up to 500 Mc/s.

Features of this tube include:

1. 14 watts c.w. input (ICAS) up to 500 Mc/s
2. 5 watts (CCS) useful power output as an r.f. power amplifier up to 500 Mc/s
   6 watts (ICAS) useful power output as an r.f power amplifier up to 500 Mc/s
3. Frame-type control grids which contribute to high power sensitivity
4. Plate and grid-No. 2 materials having high dissipation capabilities which insures low plate and grid-No. 2 emission and negligible gas evolution
5. Single cathode and grid-No. 2 common to both pentode units, this minimises effects of interlead reactance in push-pull circuits
6. Built-in neutralising capacitors connected from each plate to the control grid of the other unit which neutralise plate-to-grid feedback in push-pull circuits
7. Base-pin and internal-connector materials having high r.f. conductivity thus minimising r.f. losses.

Circle **30** *for further details.*

Pencil Tube for U.H.F. Applications

RCA announce the 6264-A medium-mu pencil triode for military and critical industrial applications. This A-version retains the desirable characteristics of its prototype and, in addition, is designed to meet special tests for low-pressure breakdown, low- and high-frequency vibration, and 1-hour stability life performance.

The 6264-A has an amplification factor of 40 and is intended for use particularly as a frequency multiplier, but is also useful as an r.f. power amplifier and oscillator. The 6264-A can be operated with full ratings at frequencies up to 500 Mc/s, and with reduced ratings at frequencies as high as 1,700 Mc/s. It can be operated at altitudes up to 60,000 feet without pressurisation.

When operated under ICAS conditions the 6264-A can deliver useful power outputs of 3·4 watts as a frequency tripler to 510 Mc/s, 10 watts as an unmodulated class C r.f. power amplifier at 500 Mc/s, and 6 watts as an unmodulated class C oscillator at 500 Mc/s.

Circle **31** *for further details.*

Rotron Flowmeter

THE Rotron flowmeter, available from Rotron Controls Ltd., measures the rotational speed of a vortex created outside the main stream, which is directly proportional to the rate of flow of the fluid in the pipeline, and provides a substantially more accurate measurement than meters normally used for this purpose.

An important feature of the instrument is a magnetic coupling which enables rotor revolutions to be transmitted to local and remote read-out devices, including mass-flow conversion units, regardless of extremely high line-pressures. Signals can be transmitted directly to data processing systems.

The simplicity of design of the instrument reduces maintenance costs to a minimum. It is calibrated to a high degree of accuracy and incorporates an internal by-pass arrangement which enables it to be adjusted to a wide range of flow rates while in operation.

Circle **32** *for further details.*

Flame Failure Control

THE photoelectronic flame failure control, Type GFF has been designed to provide a safety system for oil, gas or pulverised fuel burners. It operates on the modulation of the flame irrespective of colour or background radiation and should the flame go out then the unit will cut off the supply of fuel immediately.

In addition to operating as an on/off device in conjunction with a solenoid valve, the equipment can be fitted with an automatic sequence unit to provide a fully automatic control system for the burners. This sequence unit consists of a synchronous motor with cam system and switches to provide a sequence of operations for lighting-up, with the over-riding control of the photocell to ensure complete safety.

The equipment is complete with indicating lights to show the condition of operation and the photocell is contained in a cast aluminium tube for easy mounting.

The price is £28 per set and delivery is 4 to 6 weeks.

Circle **33** *for further details.*

Flexible Spring-loaded Terminal Blocks

A NEW flexible terminal block (Part No. 2024T/12) has been added to the standard range of Hellermann Suprafix spring-loaded terminal blocks.

This 12-way block contains the normal spring-loaded device (i.e., the button is depressed, the stripped cable end inserted, then the button released and the cable is held firmly in position) and is rated at 10 amp, 380/470 V.

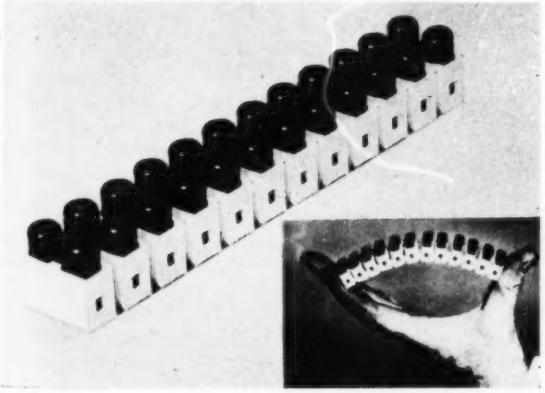
Suprafix terminal blocks and accessories have numerous applications. They are especially useful where it is important to have absolutely secure and durable connections which will withstand vibration.

The Suprafix system is used with rigid conductors with or without terminals; and flexible conductors, with terminations.

Special compression terminals have been developed for use with Suprafix blocks. Publication BH.99 contains a comprehensive list of these terminals and is available upon application.

Circle **34** *for further details.*

Flexible spring-loaded terminal blocks



Optical Character Reader

NEW equipment announced by IBM United Kingdom Ltd. reads numerical characters directly from a printed document into a computer system at a speed of 480 characters per second.

The 1418 will read two printed lines or a printed line and a second line marked in pencil or dark ink from up to 400 documents per minute. Documents may be of varying weights and sizes, although a separate run is needed for each dimension.

The 1418 has been developed for use with the IBM 1401 data processing system.

The IBM 1418 optical character reader floods each document with light from an internal light source, the reflection from the document surface being directed through a lens system onto a rotating scanning disc.

A vacuum holds the document flat against a drum as it passes the optical stations. This exposes the complete face of the document for reading. The line to be read is selected by the lens-system positioning levers which align the optical scanner over the data to be read.

The reflected light from the lens system is directed onto a rotating scanning disc. The disc has a series of 24 spirals each made up of a number of square apertures. The combined effect, of the rotation of the disc and the small squares, is an image of the character sensed. After the light passes through the fixed aperture slit it strikes the surface of the photomultiplier tube. The resulting electrical impulse is sent to a video amplifier which automatically adjusts the video signal for variations in weight of character and differences in background.

The data-consolidation circuitry in the video amplifier analyses each successive group of scans to be either black or white. The output of the data-consolidation circuitry enters a shift register large enough to contain all the cells for an area one character wide and approximately two and a half times the character height.

Approximately half the shift-register outputs are made available to the recognition logic. These are used for checking character-logic statements that are sufficiently flexible in their designs to allow a realistic variation in print quality. As a character pattern passes through the shift register it becomes so oriented that a match of the scanned pattern and the logic pattern is effected. Thus the character-logic statement for that pattern is satisfied and a recognition is indicated.

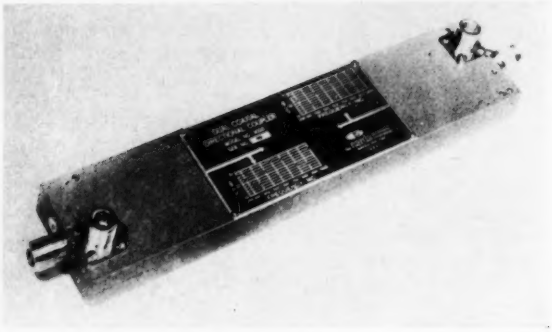
The logic circuitry of the system is composed entirely of solid state components. These components are mounted on small cards called standard modular system cards.

The 1401 has been ordered for use in the whole range of business activity, notably in banking, insurance, retail trade, manufacturing and public utilities.

Circle **35** *for further details.*

Dual Coaxial Couplers

Two new dual coaxial couplers covering the range 250 Mc/s to 4,000 Mc/s have now been introduced into the U.K. by Aveley Electric Ltd., sole U.K. agents for the Narda Microwave Corp.



Narda dual coaxial directional coupler

These coaxial couplers, designated Model 3020 and Model 3022, have been specially designed for use in coaxial reflectometer set-ups to give a 4 : 1 frequency range whilst maintaining flat coupling with high directivity. The Model 3020 covers the 250 Mc/s to the 1,000 Mc/s range and Model 3022 covers the 1,000–4,000 Mc/s range.

Coupling of rear arm is held to 20 dB ±1 dB over the required frequency range and the coupling of the forward and reverse arms track each other within a 3 dB total.

Another important feature of these couplers is a low main and secondary line v.s.w.r. The main line v.s.w.r. in Model 3020 is held to 1·05 maximum whilst the secondary line is 1·1 maximum.

Circle **36** *for further details.*

Transistor "Building Bricks"

A CHEAPER and more convenient method of obtaining power supplies for transistor circuits is provided by a new range of standard electronic sub-assemblies announced by Mullard Equipment Ltd.

The range consists of only four basic units. Yet from appropriate numbers and combinations of these, stabilised and unstabilised power supplies can be built to meet the requirements of most types of transistorised electronic equipment and control systems.

Such flexibility allows manufacturers to stock the sub-assemblies economically as normal stores items, with the convenience of immediate availability for whatever purpose they may be required.

The economic advantages of the sub-assemblies are twofold. First, since each unit is a fully engineered and proven element, the cost and effort of original development work is largely eliminated. Second, the benefits arising from the large-scale production of standardised items has minimised the prices of the units themselves, so that a stabilised 1A 30 V supply, for example, can cost as little as £25.

The range comprises two unstabilised units with outputs of up to 1 A and 5 A respectively at 0 to 39 V, adjustable in 3 V steps; a 250 mA stabiliser with a stability factor of 200 : 1 for mains variations between +10% and −15% of the nominal; and a series regulator unit.

The unstabilised units may be used alone when the circuits to be supplied are insensitive to power supply variations, or where cost is the paramount consideration. For applications requiring stabilised currents, the stabiliser and/or series regulator units are added as appropriate.

Assembly of the units into the required combination is accomplished speedily by means of simple bolt fixings.

The combinations needed for various applications are as follows:

Output	*Units required*
1 A unstabilised	One 1 A unstabilised unit (Type YL.6101)
5 A unstabilised	One 5 A unstabilised unit (Type YL.6102)
250 mA stabilised	One YL.6101 plus one 250 mA stabiliser (Type YL.6103)
1 A stabilised	One YL.6101 plus one YL.6103 plus two series regulator units (Type YL.6104)
5 A stabilised	One YL.6102 plus one YL.6103 plus eight YL.6104's.

The maximum voltage from combinations incorporating the stabiliser or series regulator units is 30 V. Coarse control of the output voltage is governed by adjustable taps on the mains transformer of the unstabilised units, fine control by a pre-set potentiometer in the stabiliser.

In addition to its main output each of the unstabilised units has two subsidiary outputs. Those of the 1 A unit provide 200 mA at 6, 12, and 24 V and 20 mA at 36 V; those of the 5 A unit provide 1 A at 6, 12, and 24 V and 100 mA.

Circle **37** *for further details.*

Super-power Beam Triode

THE RCA-6950/2039—formerly designated RCA-2039—is a super-power shielded-grid beam triode designed for use as a plate-pulsed r.f. power amplifier in such applications as long-range search radar and particle-accelerator service. With duty factor of 0·06 and pulse duration of 2,500 microseconds, the 6950/2039 can provide a useful peak power output of 1·5 megawatts at 200 Mc/s.

Design features of the 6950/2039 include double-ended configuration which permits higher frequency operation than an equivalent single-ended tube, and shielded-grid construction which permits separation of the r.f. input and r.f. output circuits for grid-drive operation at very-high frequencies.

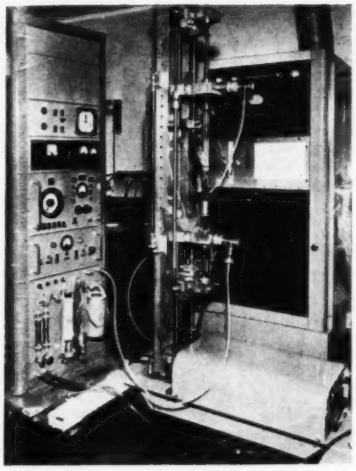
Additional features include low-loss ceramic bushings, large-area terminals, internal water ducts, accurate alignment of symmetrical array of unit electron-optical systems, and a multi-strand thoriated-tungsten filament for economical operation, high emission capability, and long life.

Circle **38** *for further details.*

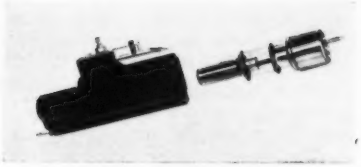
Induction Heater for Zone Refining

DELAPENA & SON LTD. are now producing their induction heating r.f. generator, Model E 9 ZS, as a standard model. It is similar in general arrangement to the E 9/12 series but has been developed specially for semiconductor crystal growing and zone refining.

The prototype was produced to the requirements of the Royal Radar Establishment, Malvern, and a small number have subsequently been manufactured to special order.

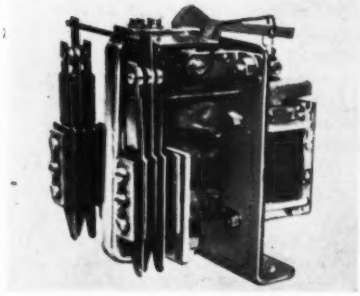


Vacuum switch, Types **183** *and* **85** ▶



◀ *Model E 9 ZS induction heater in use for floating zone refining of silicon crystals*

Electrically reset latching relay, Type UNIV/LA/S ▶



Power Ratings

Power output, continuous (to BSS.1799 : 1952)	9 kW
Power input (at 9 kW output)	20 kVA
power factor	0·85
voltage input tappings on mains transformer	360/440 volts
Operating frequency	4 to 5 Mc/s
Dimensions	
Width ... ... 30 in.	(768 mm)
Depth ... ... 36 in.	(915 mm)
Height ... ... 71½ in.	(1,831 mm)
Weight ... ... 1,522 lb	(690 kg)

Matching the load

(1) Boost condensers are fitted internally. They are adjusted for the particular application and normally left permanently in circuit.

(2) It is recommended that power control be obtained by fitting a Variac variable transformer, Type 50 BG 3M, outside the generator, connected into the h.t. transformer primary leads.

Circle **39** *for further details.*

Vacuum Switch 183 and 85

THE vacuum switch, Type 183, from B. & R. Relays, may be supplied separately or complete with a plastic housing which is then designated Type 85.

The vacuum switch is a component capable of switching loads of up to 2 kW at voltages ranging up to 3,000 V. Reliable contact make is always guaranteed, even with very low voltages and very infrequent operation, as the point of contact is protected against all forms of contamination. As a self-contained unit the vacuum switch may be easily adapted to the most varying constructions. High and inductive loads may be switched with the utmost safety.

It is used for switching h.t. voltages in radio installations, fluorescent tubes, medical apparatus, and also for generating ignition voltages in temperature regulators and also in communication engineering.

Circle **40** *for further details.*

Latching Relays

THE latching relay, Type UNIV/LA, which can carry up to eight contact sets, normally open, normally closed, changeover, or mixed, is held by a simple latching mechanism in the energised position after a short pulse is applied to the coil. When the lever attached to the relay is pressed, the relay contacts are released to the de-energised position, remaining there until a further pulse is applied to the coil.

The range of coils available covers requirements up to 440 V a.c. or 230 V d.c. Current rated coils are also available. Consumption rating depends upon number of contacts to be operated, maximum continuous rating is 12 VA, intermittent up to 18 VA.

The latching relay of the UNIV/LA/S is similar to the hand reset version above, but can be both latched and unlatched by electrical impulse. It is fitted on a substantial plate serving also as a mounting bracket. Attached to the plate is a small solenoid which, when energised, releases the latching device.

The operating voltage for the latching coil is the same as for the UNIV/LA.

The operating voltage for the release coil is 110 V 50 c/s, 200/250 V, 50 c/s, 400/440 V 50 c/s. Consumption 6 to 10 VA.

Circle **41** *for further details.*

Miniature Twin-Diode—High-Mu Triode

RCA announces to equipment manufacturers the 14GT8—a twin-diode—high-mu triode of the 9-pin miniature type. This tube, formerly known by its developmental number A-5997, is intended particularly for use in f.m. receivers.

In such equipment, the diode units of this tube may be used in ratio-detector or discriminator circuits. The triode unit is especially useful as an audio-frequency amplifier. Each of the three units has its own cathode with individual base-pin terminal. This electrode and basing arrangement provides good electrical isolation between the diode and triode units.

Circle **42** *for further details.*

Dust-free Cabinets

SPECIAL cabinets which enable precision-made components to be assembled in dust-free conditions prior to inspection and testing have been designed and manufactured by Plannair Ltd. for use in the new Vactric (Control Equipment) Ltd. factory at Acton.

The new cabinets, which give a steady flow of low-pressure filtered air, are being used for the selection and

assembly of motor housings, stators and rear-end frames in the manufacture of miniature servo-motors. Air is drawn through two filters at the back of each cabinet where it is heated and then forced into the assembly area by a Plannair 5 in. axial flow blower providing a filtration of five microns.

The assembly area in each cabinet consists of a transparent roof and a transparent door which, when opened, automatically switches on a light and allows the operator to insert his hands, one on each side of a narrow Perspex flap. This simple device prevents the withdrawal of both hands in order to assemble a component outside the cabinet and away from the filtered air.

The designers have also ensured that the transparent roof has no horizontal crosspiece to restrict the operator's vision. The height of the assembly area is adjustable to suit the convenience of the operator, and the cabinet stand is supplied with an adjustable foot-rest. There are no restrictions on smoking during assembly, an ashtray being fitted within easy reach on the right of the cabinet.

After assembly, all the servo-motors are subjected to intensive inspection and testing. Any dirt on these components would be immediately detected by a reading of the breakaway torque.

Circle **43** *for further details.*

Combustion Safeguard Relay

AN improved Protectoglo combustion safeguard relay using the flame rectification principle, has been developed by Honeywell Controls Ltd.

The Protectoglo system is suitable for monitoring start-up, cut-off for gas-fired or oil-fired ovens, furnaces and the like. The relay itself is designed for use with a variety of sensors: flame electrode, photocell unit, infra-red or ultra-violet types. Two different kinds of sensor can work-in simultaneously to the same Protectoglo.

For gas flames, a flame-electrode rectifier would normally be used, the electrode being inserted in the flame which forms part of the circuit. The flame will act as a rectifier if interposed between two electrodes of unequal area; the burner, or ground electrode when used, will generally have an area of contact many times that of the flame electrode.

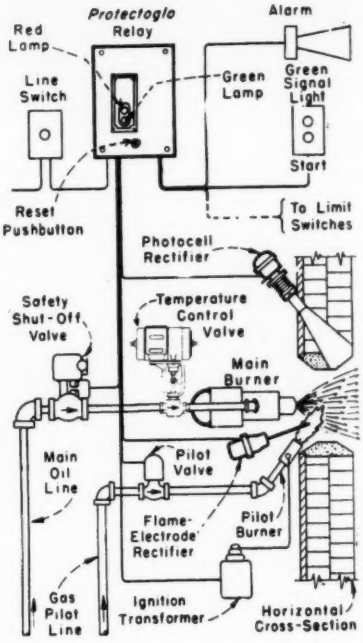
For oil flames a photocell rectifier is generally sighted onto the flame.

For gas or oil or combined flames, an infra-red sensor in the form of a lead sulphide cell responds to pulsating infra-red radiations and unidirectional current is produced by means of an adaptor circuit.

Another, more unusual sensor is the ultra-violet detector. Typical uses of this detector would be dual fuel installations, high intensity gas flames, exothermic gas generators and other difficult applications.

When flame is present, rectified current is fed to the Protectoglo relay into one grid of a double-triode electronic tube. The triodes are connected so that the output current will energise the control relay. On flame failure, no rectified current can be produced the tube output current will drop to zero and the control relays will "drop out".

The self-checking safe-start circuit in the relay includes a safety switch and a manual reset button.



Typical combustion safeguard system incorporating new improved Honeywell Protectoglo relay. This scheme gives automatic cut-off on flame failure, push-button electric ignition, automatic purge timing. Two sensors work into the same relay in this example.

If a fault is detected during start-up and the safety switch goes into safety position, the system cannot be started until the unsafe condition is corrected and the manual reset button actuated.

When it is required to prevent any attempt to start the burner until expiration of a measured time interval, during which the combustion space may be thoroughly purged of any accumulation of unburned fuel, a purge timer is supplied. This timer is located in the upper right-hand corner of the relay. The purge timer is fully adjustable from 2 to 15 minutes or alternatively 4 to 30 minutes. At the end of the purge timing period, an external signal light indicates that the burner may be started.

Circle **44** *for further details.*

Portable Air Compressor

B.E.N. PATENTS LTD. have produced another new unit in their range of portable air compressors—the "PD three" unit.

The "PD three" is a versatile, fully mobile, multi-purpose unit specifically designed for general use in car showrooms, small garages and workshops, also for spray painting, house decorating, creosoting and agricultural purposes—spraying insecticides, etc.

The single cylinder air cooled compressor (which also incorporates a moisture separator and pressure gauge) displaces 2·58 cu.ft at 100 p.s.i. It is direct coupled to a ½ h.p. electric motor and the unit is secured to a welded tubular steel frame mounted on generously proportioned rubber-tyred wheels. A conveniently positioned tubular steel handle welded to the frame is fitted with carrier brackets for the hose and cable (supplied as standard fitments) and these features combine to make a sturdy, easily manoeuvrable outfit.

With the number of working parts reduced to a

minimum, the "PD three" provides constant trouble-free service under the most severe working conditions, and requires no attention other than occasionally topping up with a light air compressor oil.

As a special feature of the "PD three", the motor incorporates a Thermotrip cut-out device which effectively protects it against overload or burn-out.

A "Vari-Pressure" control valve permits an instant choice of operating pressure for any required duty by the one-hand manipulation of a milled adjusting nut.

Supplied complete with 15 ft length of $\frac{3}{16}$ in. i.d. air hose, with ferruled connections and tyre chuck, and 15 ft length of 3-core C.T.S. electric cable. The price is £39 10s. 0d.

A B.E.N. IM spray gun can be supplied as an extra and hangs on the hook at the back of the tubular steel handle. The Model IM spray gun which is ideal for use with the "PD three", utilises the internal mix principle and works at a comparatively low pressure with relatively little air consumption. The price is £7 9s. 0d. extra.

Circle **45** *for further details.*

Room Thermostat

THE RHEOSTATIC CO. LTD. have developed a new Satchwell TM room thermostat.

This thermostat has been designed to give accurate control in a wide variety of applications. It can handle currents up to 20 amperes a.c., and is also suitable for the control of small relays. The thermostat uses a bi-metal strip to control a Satchwell magnetically-controlled microswitch; it is designed to maintain high contact-pressure up to the instant of breaking.

Various models are to be available: they all have an accelerator heater which, by anticipating a rise in temperature when the thermostat is calling for heat assists in reducing temperature overshoot due to thermal relays. The instrument has a mechanical differential of 2°F (1°C); it is claimed that practical tests have shown that the actual working differential of the TM in the majority of typical applications is less than $\frac{1}{2}$°F.

The arrangement of the mechanism so that full pressure is maintained between the contacts until the moment of break, this together with the magnetic make-and-break control enables the thermostat to handle the current previously indicated without radio interference.

It is compact ($4\frac{1}{8} \times 2\frac{3}{4} \times 2\frac{1}{2}$ in.) and is moulded in tough polystyrene. Selection of the required control temperature is facilitated by the use of a grey dial with a serrated edge: adjustable stops are incorporated which can be set to limit knob travel to selected high and low positions. The TM can be supplied with a thermometer incorporated in the knob; the temperature indicator is seen through a transparent disc and is read against the scale used for the thermostat.

The list price of the instrument is £3 1s. 0d. List price of the industrial model is £3 4s. 0d.

Circle **46** *for further details.*

Unit Contactors

DEWHURST AND PARTNER LTD. have produced a new range of unit contactors. Known as the H series these contactors are available in 50, 100 and 200 amp versions for a.c. or d.c. working. Each version may be supplied as a single or multi pole unit. The construction allows additional poles to be added (within each version) to a single pole unit, without changing the coil.

The unit mounting and front wiring of these contactors facilitates installation and maintenance, as does the single screw fixing of the coil and contacts. All units are exceptionally quiet in operation, making them ideal for applications where extraneous noise must be kept to a minimum. Rated to BSS.775 (A4 or D4) and having full C.S.A. approval they are short circuit tested at 31 MVA, against their respective HRC fuse ratings.

A blowout system incorporating separate tungsten arcing contacts obviates derating and ensures long operating life.

Extras available include auxiliary contact assemblies and damp and dust protecting or weatherproof case.

Circle **47** *for further details.*

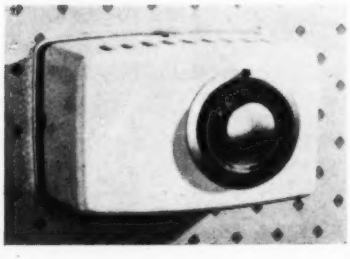
Compressed Air Filter-Regulator Unit

THE new Norgren Series 73AC compressed air filter-regulator units are available in $\frac{1}{4}$ in. and $\frac{3}{8}$ in. pipe sizes. These units provide efficient filtration and accurate pressure regulation in a compact, economical unit.

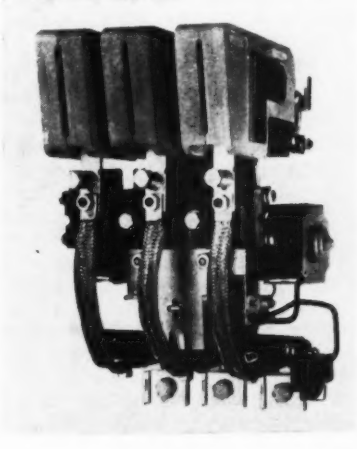
Air first enters the filter section of the unit where a

◀ *B.E.N. PD3 portable air compressor with B.E.N. IM spray gun*

Satchwell TM room thermostat



Unit contactor ▶



deflector causes a swirling motion in the air, whereby a centrifugal action removes liquids and the heavier dirt particles. A "quiet zone" in the lower half of the filter bowl retains the separated liquids and prevents their return to the air line.

Air then passes inwards through a filter element and so to the regulator part of the unit. There is a choice of four grades of sintered bronze filter element or, alternatively, a monel screen filter element. There is lso a choice of transparent plastic or metal bowl on the filter part of the unit.

A balanced regulating valve, together with a Norgren baffle and syphon tube feature ensure that the regulator part of the unit provides an output with excellent flow and regulation characteristics. There is a choice of three regulating spring ranges and both relieving and non-relieving types of unit are available.

The unit is suitable for input pressures up to 150 p.s.i. when fitted with transparent bowl or 250 p.s.i. when fitted with metal bowl. The respective inlet temperatures are 120°F and 200°F.

Circle **48** *for further details.*

Air Speed Indicator with "Split Pointer" Presentation

ORIGINALLY developed for standby use in the de Havilland Trident (whose primary A.S.I's are servo-driven), this new instrument combines the mechanism of the conventional capsule-operated air speed indicator with a new form of pointer presentation designed to provide maximum readability without fear of ambiguity.

The "split pointer" is actually a two pointer instrument, but these are so arranged that at no time is more than one of them effective in the indicating sense. The pointers are concentrically mounted one behind the other, the rear one being longer, and are driven from the same pressure-sensitive mechanism. For the first revolution, both pointers, held in alignment by a hairspring, traverse the dial together, the readings being taken against the outer, or low range scale. The smooth transition from "low" to "high" range is accomplished when the white-painted extremity of the longer pointer passes from view behind a raised mask on the dial plate, which prevents any further movement of this pointer in the "increase" direction. The front pointer, now effectively shortened, continues round the dial and covers the high range on a separate scale. Both scales are linear and divided in 5-knot increments.

Circle **49** *for further details.*

Rodene Timer, Type 7000, Mark II

THE Type 7000 process timer, made by the Rodene Electrical Co. Ltd., has just been replaced by a re-designed model, the Mark II.

The changes include the use of new materials, such as "Alkyd" for the contact actuators and the replacement of the friction drive, usually fitted to prevent damage if the dial setting is altered while the timer is running, by a new free-wheel which picks up within a tenth of a degree and gives a solid forward drive.

Other changes are as follows: The motor now has a larger coil wound on a moulded nylon bobbin, which raises the maximum voltage to 440. There is now a choice of ten ranges with full-scale times of $\frac{1}{4}$, 1, 4, 12, 36 or 72 minutes and 3, 12, 24 or 96 hours; this timer is available for flush or projection mounting and the removable key illustrated can be provided as an alternative to a fixed setting knob.

The new moulded base allows bigger screw-type terminals in wire-retaining recesses and gives better "creeps and jumps" figures. It also allows more connections to be brought out thereby increasing the flexibility of use. For instance the clutch can now be fed from a separate d.c. source to prevent resetting on mains failure or during breaks in an intermittent process. In the latter case, as the motor is the special instant-start Rodene type the timer will accurately summate the running times.

This timer can be connected to start when a switch is closed and to reset instantly when it is opened, or it can start on a pulse and reset automatically. The output contacts can be operated for the duration of the timed period, or from the end of the timed period until the timer is reset. It also provides a pulse at the end of the time period which can lock up a contractor or start a further timer.

The timers are available from the Rodene Electrical Company's distributors, D. Robinson & Co. Ltd.

Circle **50** *for further details.*

Leveltron Automatic Bin Level Controller

A SPECIALLY DESIGNED automatic bin controller has been developed by Thomas Industrial Automation Ltd. to cover the automatic filling and emptying of bins, tanks and silos. Units can be supplied to cover any number of bins or silos.

Each bin is fitted with Leveltron high and low level control units, and solenoid or motorised valves for filling and emptying. A cyclic selection device in the console unit samples the signal from the high level controllers in any desired sequence. If the level of material in the bin being sampled is below the high level electrode, the sampling device will come to rest in that position and the filling valve in that bin will be opened. When the level of material reaches the high level electrode, the valve will close and the sampling mechanism will start to cycle again. If a bin is already full then the sampling device will pass over it and continue to the next bin in the sequence. A similar process takes place at low level in conjunction with the emptying valves on the silos.

A removable dustproof panel is fitted at the rear of the cabinet to give easy access to ancillary equipment and wiring mounted behind the main assembly panel.

The width of the 6 point console is 2 feet, height 5 feet, and depth 1 foot 3 inches, and any size of installation can be dealt with and quoted for.

Circle **51** *for further details.*

Electro-hydraulic Tension Cell

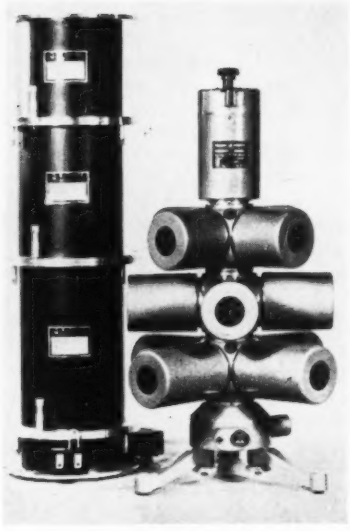
SALFORD ELECTRICAL INSTRUMENTS LTD. has introduced an electro-hydraulic tension cell with in-built pressure transducer. It is particularly suitable for crane weighing applications, where it would give advance warning of overloading on the crane boom. The cell can be built into the crane structure, avoiding the problem of cable reeling.

Requiring a mains supply only, this cell provides a

Panel meters

Switchless capacitance standards ▶

◀ *Electro-hydraulic tension cell with in-built transducer*



simple two-unit remote indicating system with no amplifiers or power units needed. Relays and other ancillaries to provide alarm or control facilities are available.

The cell or hydraulic support is essentially a shallow cylinder having its piston or platen bonded to its walls by a flexible rubber joint. The space under the platen is filled with a suitable liquid, which for practical purposes is incompressible if all air is extracted.

As the volume of the liquid remains constant, there is no axial movement of the platen when loaded, so that none of the load is taken by the rubber joints and the whole is transmitted to the fluid. The platen, however, is virtually floating and can tilt to accommodate eccentric loading which is resisted by a balanced shear in the joint on opposite sides. This does not affect the hydrostatic measurement of the load.

A conical forged steel top dome houses an in-built Bourdon pressure transducer, and electrical connection to the transducer is via a de-mountable connector and a flexible 3-way lead.

Circle **52** *for further details.*

Panel Meters

A NEW design surface mounting panel meter range by Parker Instrument Corp. of America is being marketed in this country by Painton & Co. Ltd.

The meters feature a ceramic ring magnet and printed circuit coil. The printed circuit coil overcomes the usual drawbacks of ceramic magnets yet allows utilisation of their long time stability.

The entire movement assembly is mounted between steel shields—all within the scale housing—thus allowing nothing to project behind the panel except meter terminals.

Short overload (1/10 sec) to more than 20,000 times the rating of the instrument produces no harmful effects, nor disturbance to the basic accuracy.

Overload of 500 mA with a 2 mA movement sustained for 1 full minute caused no harmful effects. Where the nylon printer was bent by surge overload, it could be straightened and accuracy was as rated.

A bar magnet (200 oersteds) applied directly to the meter case did not disturb performance.

Temperature tests within the manufacturers stipulated limits caused no disruptive effects, nor was accuracy affected.

The meter is being manufactured in ranges of 1 milliampere to 1 ampere and 10 volts to 500 volts. The case is not ruggedised for military applications but such models are promised. Tolerances are available on selection at 0·5% standard 1% of full scale.

Circle **53** *for further details.*

Switchless Capacitance Standards

A WIDE range of switchless capacitance standards have been introduced by Aveley Electric Ltd.

The availability of a high-grade capacitance standard of wide range makes possible the use of accurate capacity measurements by simple substitution and inductance measurement by resonance methods at standard frequences, as well as serving as laboratory references.

The Jahre system uses 5 and 6 sided connector blocks (dice-connectors) and plug-in units to give combinations of 1-2-3-4, adding up from 10 pF to 10 mF in 10 pF increments.

The "Xmas Tree" assembly has proved easy and rapid in laboratory use, occupying little bench space. Unused ports on the connector blocks are covered by screening caps while the capacitor units are stored in polished wood racks. The rigid construction ensures stability of the standards with normal care in handling without "cotton-wool and glass case" treatment. Variable capacitors provide continuous coverage of 16 or 70 pF, with discrimination of 0·01 pF and 0·1 pF respectively.

Air dielectric is used in the sizes up to 400 pF which have loss factors below 1 in 10^5. The coaxial system of connection of the units ensures complete screening and high natural resonant frequency, series inductance being less than 0·06 μH per unit.

Each capacitor is adjusted to ±0·1% ±0·1 mmF and calibration certificates are issued for each unit and for the connected assemblies. The stability is of a very high order proved by measurements over several years, and is guaranteed better than 0·05% per year. In practice, with reasonable usage, drifts of the order 0·01% per annum may be expected. Temperature coefficients are +20 p.p.m./°C for the units up to 400 pF and 30 p.p.m./°C for the larger units.

Circle **54** *for further details.*

Counter Batcher Programme Controller

PHOTOELECTRONICS (M.O.M.) LTD.'s new counter batcher programme controller, Type CBP, is said to overcome the many disadvantages associated with cold cathode decade counting tubes previously used for this type of operation. It consists of a number of plug-in decade units which are fully transistorised and constructed on a printed-circuit enabling rapid changing of units to provide programming sequences for any type of installation. With this type of construction eliminating all mechanical switches, the speed of operation, both for straight-forward counting and with full pre-selection of batch quantities, is at the rate of 3,000 per second. Any number of decade units can be used in one unit to provide totals to any number of digits. The equipment is provided with a number of pre-batch impulses for warning or other programming control and indication of count is provided by a series of neon tubes illuminating their respective numbers in turn.

Any conventional method of input can be used with this unit, including photo-transistors, and suitable power supplies are incorporated for operating these. It can also be connected to the mains and use the frequency as a time base with multiple outputs for programme control.

The price is from £85 0s. 0d. and delivery is 4 to 6 weeks.

Circle **55** *for further details.*

Miniature Potentiometers

DESIGNED for use in transistor circuits, the new range of potentiometers from Egen Electric Ltd. incorporates many features of interest in the field of miniaturisation. Robustly constructed on a die-cast body of ½ in. diameter, these bush mounted controls have a tough moulded spindle of $\frac{3}{16}$ in. maximum diameter and will be available with standard resistance values in the range 1,000 ohms to 3 Megohms logarithmic or linear law. Lower values can be made to special requirements. Two models will be manufactured initially, Type 363—non-switch and Type 365 with 50 V, 150 mA d.p.s.t. switch, both with standard soldering tags.

Circle **56** *for further details.*

Radar Output Recorder

THE Special Projects Department of I.C.T. has been awarded a contract by the Ministry of Aviation for the design and manufacture of equipment that will record the output of precision tracking radar.

The final purpose of the equipment is the recording of the azimuth and elevation readings of the radar's target in digital form on punched cards. However, because the radar data has to be examined at high rates an intermediate stage of recording on magnetic tape with slower replay into punched card equipment is necessary.

The radar's output consists of digital measurements of the azimuth, elevation and range of the radar beam. together with voltage signals representing the angular distance of the target from the centre of the beam The readings of the position of the beam itself will be recorded in their digital form directly on the magnetic tape, while the voltage error signals will first be converted to digital form by high-speed digital to analogue converters before being recorded simultaneously on the same tape.

A separate equipment will convert the tape to punched cards by replaying the tape at a slower, more suitable speed, via conversion equipment into a card-punch. Thus the transformation of radar-target data into punched-card form is completed.

The whole equipment will use solid-state techniques and at each stage a measure of self-checking will be incorporated so that a high degree of operational reliability is to be expected.

In addition there is a requirement for a "quick look" capability. Equipment will be produced which will take the primary tape and replay it into an existing real-time computer and by examining the computer's output an operator will be able not only to get a quick appreciation of the course of the radar's target but also to eliminate readily those parts of the record that are not of immediate interest and which need not be converted to punched cards. To carry out this editing operation the operator will have available the facility for replaying the record not only at high speed but also at lower speeds even down to one reading at a time. The whole range from full speed to "single-shot" will be available.

Two identical recording and editing facilities have been ordered together with a single magnetic-tape to punched-card converter.

Circle **57** *for further details.*

Transient Voltage Surge Detector

PORTABLE WELDERS LTD., of Castle Mills, Buckingham, have introduced a detector which, when connected to the circuit under test, will enable the actual surge to be seen on a c.r.o. as a fixed image. Differing condenser values are then brought in until the surge is greatly reduced, and finally resistance is brought in, until the surge is still further reduced or disappears altogether. The values of C and R obtained by this equipment become the suppression constants for the particular network, no matter how complex that network may be. Frequencies and voltages used in the network under actual working conditions are immaterial, the transient surges having already been greatly reduced or completely eliminated. The whole time taken to establish the exact values of C and R in a complex circuit might be as little as ten to fifteen minutes.

The detector is housed in a steel case with an overall depth of 9¼ in. and overall height of 6½ in. The front panel on which all the terminals are mounted measures 6 × 7 in., and the whole unit weighs 5 lb. Input is 230 volts, 10 milliamp, 2½ watts. To keep the cost of the detector as low as possible, the manufacturers, Portable Welders Ltd., have not provided the oscilloscope, resistances or condensers as these are usually

already available. The price of the unit is £30, and delivery is three to four weeks.

Circle **58** *for further details.*

Photocell for Infra-red Applications

MULLARD have developed a new photoconductive cell, the ORP13. It is intended for applications involving infra-red spectroscopy and research into the properties of materials.

The cell, which has a sensitive area of approximately 3 mm² of indium antimonide, is attached to its own Dewar flask and is cooled by liquid nitrogen to a temperature of 77°K (−196°C). This cooling system enables very good noise figures to be obtained and its efficiency is such that the cell can be used for 45 minutes without refilling the flask.

The spectral range of the ORP13 is from visible to about 5·4 μ, the peak occurring at between 4·5 and 5 μ. Its sensitivity to monochromatic radiation is 15 mV per microwatt of incident radiation.

The noise equivalent power (N.E.P.) per unit bandwidth (1 c/s), which is a measure of the smallest radiation power conveniently detectable by the cell, is better than $1{\cdot}3 \times 10^{-11}$. This figure gives an area-normalised detectivity (D*) of better than $1{\cdot}3 \times 10^{10}$ cm W^{-1}.

D*, unlike N.E.P., is independent of sensitive area since it is the square root of the sensitive area divided by N.E.P. It is a figure of merit for photocells used for detecting low level radiations and represents a basis for the comparison of photocells of different sensitive areas and different materials.

Circle **59** *for further details.*

Proximitron Industrial Detector Unit

THE Proximitron Type S unit is a transistorised proximity detector which signals the presence or absence of a metallic object in a given region of space.

The equipment consists of a sensing element and a control unit. The accompanying photograph shows a probe type of sensing element and illustrates the compact design of both the probe and the control unit. A variety of sensing elements is available including loop coils (which may be buried in the ground), annular coils and probes, which will detect the presence or position of both ferrous and non-ferrous metals and can be used for such purposes as counting, batching, control, press clearance detection, drill breakage detection, safety gate control, and checking the omission of metal closures in bottling plant. The sensing elements are not affected by the presence of dirt, oils or ink.

Proximitron industrial detector unit

Proximitron units are particularly suitable where the mechanical actuation of switches is undesirable. The field of detection can range from a fraction of an inch to several feet, according to the type of probe selected.

The control unit is of interchangeable plug-in design, housed in a neat sealed container of robust construction. The unique circuit techniques used ensure long-term stability and immunity to the effects of temperature variation and vibration. The resultant indication may be either relay closure or balanced d.c. pulse.

The instrument is manufactured by Mec-Test Ltd.

Circle **60** *for further details.*

Projection Tube for Industrial Use

MULLARD are now marketing a new high brightness 5 in. diameter industrial projection tube intended for applications where large screen displays are required.

The tube, Type MW13-38, has a light output of 2,813 ft lamberts at an anode voltage of 50 kV and this makes possible, using a suitable optical system, an optical magnification of 40 times. This means, with a raster size of 72 × 96 mm, that displays of up to 12½ ft high can be shown.

It is envisaged that the tube will find its main use in industrial television and also in such applications where a large-scale display of data handling information is required—for example, in air traffic control.

Magnetic focusing and magnetic deflection are used and the tube is manufactured from a non-solarising glass to prevent the screen blackening. Typical operating conditions are; Va=50 kV and Ia (pk)= 2·5 mA. At an average current of 500 microamp, a resolution of better than 625 lines is obtained.

As a safety precaution against the high operating voltage, an internal spark trap is incorporated to prevent internal flashover between anode and grid, and also the neck and cone of the tube are coated with an insulating material to prevent voltage breakthrough to components on the neck.

The tube has a white phosphor screen but it can also be supplied with red, green or blue phosphors for large area colour projection displays. The maximum overall length of the MW13-38 is 374 mm and it uses a B12A base.

Circle **61** *for further details.*

Automatic Light Controls

CONTROL DS.11.D is a photo-electric apparatus which controls automatically the illumination in streets and other places. It will switch on directly any lighting installation up to 1,200 VA at any desired degree of ambient illumination; an intermediate relay, suitably rated, should be used for larger loads.

Its main feature is an automatic sensitivity compensating circuit consisting of a time switch with a synchronous motor which sets the control automatically during the night for reduced sensitivity for morning operation, since the human eye is more sensitive to

light in the morning and requires less illumination than in the evening. During the day the control is re-set automatically for higher sensitivity for evening operation.

The control incorporates a high-vacuum photocell, two ELESTA cold cathode tubes, with very long working life, used in a multivibrator circuit, a rectifier and a voltage stabiliser to rectify and stabilise mains fluctuations, and a delayed action output relay which counteracts any interference due to brief fluctuations in ambient illumination.

Control DS.12 is suitable for regulating automatically the ambient illumination of all kinds of lighting installations; illumination of industrial and office blocks, streets, subways, window displays, advertising signs, staircases, signal lamps, etc.

The control uses a high vacuum photocell in a circuit incorporating ELESTA cold cathode tubes and carefully selected components. A delay-action circuit counteracts the interference caused by brief fluctuations in ambient illumination such as lightning or car lights.

Control DS.12 is suitable for both indoor and outdoor mounting. With indoor mounting the control should be in close proximity of the window through which daylight usually enters the room.

Control DS.20B is a light-sensitive apparatus for the automatic control of illumination; it will switch on directly any lighting installation up to 1,300 VA at any desired degree of ambient illumination. It is suitable to control the illumination of streets, shop window displays, advertising signs, signal lamps, and indoor lighting installations of all kinds.

A special delay-action circuit is incorporated which prevents unwanted triggering by brief fluctuations of the ambient light, as might be caused by car lights or lightning. It is suitable for both indoor and outdoor mounting.

These light controls are available from Britex Ltd.

Circle **62** *for further details.*

Trace Interrupter

THE trace interrupter has been designed as an accessory to the Bryans Aeroquipment 'X' and 'Y' co-ordinate plotting table, and enables curves to be plotted in numerous patterns of trace, instead of a continuous line. The unit will produce three basic patterns of trace, selection of which is by means of a switch:

"Short"—a series of short dashes with a low mark to space ratio.

"Long"—a series of long dashes with a high mark to space ratio.

"Alt."—a series of alternating short and long dashes.

A "frequency" control on the unit varies the repetition frequency of the dashes to enable a suitable rate to be selected for a given table pen speed. This control enables the user to produce various patterns of the "short", "long" and "alt." tracings, thus providing a number of identifiable traces at a given pen speed.

The unit obtains its power from the 'X' and 'Y' co-ordinate plotting table by means of a lead, which plugs into the signal socket on the table. A 12-way plug is also fitted for the normal signal connections to the table.

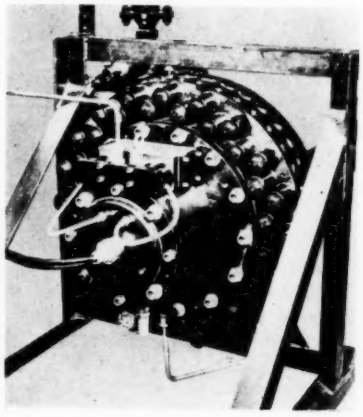
When using the trace interrupter with the plotting table the table pen lift switch is placed in the "lift" position. If the switch is set to the "write" position, it will override the interrupter and a continuous trace will be drawn. The control on the interrupter should be turned to "off" when it is required to lift the pen.

Circle **63** *for further details.*

40-Way Selector Valve

A 40-WAY selector valve has been developed by Plessey Nucleonics Limited for the burst fuel element detection system at Trawsfynydd Nuclear Power Station.

The features of this valve are its reliability and full efficiency under the special operating conditions which require it to work unattended for periods of two years. This means that since the valve has a cycling time of thirty seconds, it will cycle more than 2 million times in that period. These features have been achieved by metallurgical and mechanical development, with the entire driving mechanism grouped in a serviceable sub-assembly which incorporates a self-sealing device for rapid removal, on load, without additional shut-off.



40-way selector valve developed by Plessey Nucleonics Ltd. for the burst slug detection system at Trawsfynydd Nuclear Power Station

This sub-assembly can be removed and replaced without difficulty in less than twenty minutes. In order to ensure positive and accurate location at each index P.N.L. have built into the valve a ratchet indexing mechanism. As a result of the valve's contained pneumatic operation, which makes an external driving shaft unnecessary, there is no need for rotating shaft seals and the static seals used ensure that the leakage to atmosphere is zero.

Equipment for the detection of serious element failures during reactor shut-down is also being developed by P.N.L. for Trawsfynydd. This makes use of the characteristic alpha emission of uranium.

Circle **64** *for further details.*

Liquid-Level Alarm Switch

LATEST addition to the range of packless flexible-shaft level controllers produced by AEI Instrumentation Division is the Model 26 liquid-level alarm switch.

Of simple yet robust construction, the Model 26 switch has no rubbing parts and incorporates the AEI patented flexible shaft with displacer. The result is a low-priced instrument for which is claimed the accuracy

and reliability normally associated with more expensive flameproof switches.

The switch is operated by a change in the buoyancy of the displacer, and not by movement of a float "riding" on a changing liquid level. Any displacer motion is transmitted to the micro-switch by a stiff tongue within the flexible shaft. A limit stop is provided to ensure that the stress in the flexible shaft is kept within the elastic limit.

The switch is capable of direct or reverse action, is easy to instal being mounted on standard flanges, and is dependable, a buoyancy change of less than six ounces providing full actuation of the micro-switch, e.g., a level change of approximately $\frac{1}{2}$ in. at specific gravity of 1·0.

The switch and terminal housing is insulated from the flange by an asbestos gasket, enabling the instrument to be operated at high process temperatures. Permissible temperature range is −65 to 500°F.

List price of the standard instrument is £19.

Circle **65** *for further details.*

Frequency Meter and Discriminator

A WIDE-RANGE pulse-count electronic frequency meter (Type 1142-A), direct-reading over a range of 3 c/s to 1·65 Mc/s, has been developed by the General Radio Co. and is available in this country through Claude Lyons Ltd.

Frequency meter and discriminator

By means of a calibrated scale-expansion technique, a direct-reading accuracy of 0·1% is achieved.

In addition to its use in direct frequency measurement, the instrument can be used to make highly precise frequency-drift measurements on oscillators and other generators. By measurement of the heterodyne beat between the oscillator and a suitable frequency standard, an accuracy of one part in 10^9 can be obtained.

A d.c. output for operating a recorder is provided; this is particularly useful in frequency-drift measurements.

With the aid of a wave analyser, incidental frequency modulation can be measured down to 1 part in 10^6 directly; by indirect methods, down to 1 in 10^9.

Input sensitivity of the instrument is 20 millivolts. Discriminator residual noise is 100 dB below full scale.

The overall size of the frequency meter is 150 × 305 × 300 mm. Its net weight is 6·9 kg.

Circle **66** *for further details.*

Automatic Personal Identity Code

A PROGRAMME newly developed for the IBM 650 computer introduces a new approach to the filing of records in a large organisation, which will save space, time and mistakes.

Called AutoPIC, for Automatic Personal Identification Code, the programme automatically converts any name into a "numerical signature" fifteen characters in length.

Of these the first ten are derived from combinations of letters in the name and the remaining five are codes representing personal data to be recorded, which may include home address, occupation, description, date of birth.

By this means it is possible to eliminate separate files maintained by different classifications and to produce a single, consolidated master file based on all recorded personal data. Although arranged by number—only the first character of the code is a letter—code numbers are in effect maintained in the alphabetic order of the original name file.

In the remote event that a file contains two persons with identical names and personal data, the AutoPIC code will be identical for both, but provision is contained in the programme for these to be recognised and re-coded.

At present the AutoPIC programme is available only for the IBM 650 computer, but programmes are under development for its conversion to other IBM data processing systems.

Circle **67** *for further details.*

Enlarger

THE Kamm enlarger has many useful applications in industry and commerce. It can be used to enlarge reproductions of plans, engineering drawings, maps, artwork, and other matter.

With an 8 in. lens, enlargements up to eight times, and reductions to five, are possible.

Construction consists mainly of a self-supporting welded box form section, with adjustable wall-mounting brackets. Moving parts are ball-bearing mounted, being motivated through heavy-duty cable by two independent control handles in front of the machine. The unit is fully counterbalanced.

The enlarger head supports a 12 in. cold cathode lighting unit and negative holder to take negatives up to 10 × 8 in. (A condenser head can be supplied instead if required.) There is a micro switch to prevent light spill when changing negatives.

Maximum enlargement is ensured by the lens panel and mount having been designed as an enlarger head to give minimum distance between negative and lens. The quick-action release lens mount enables movement around the optical axis. A swing filter is provided.

The tilting table measures 40 × 30 in., being supported by a grid to maintain flatness. Locking for tilt is placed immediately below the table surface, being fitted with double-action quick-release locks. The design ensures positive zero locking position.

The control unit permits a wide angular position of control handles and there is ample knee room for the operator. A clutch unit, adjustable to any requirement of sensitivity, also locks the control wheels in one movement.

The price of the standard unit is £275, ex-works.

Circle **68** *for further details.*

Remote Handling Equipment

NUCLEAR EQUIPMENT LTD. have developed three new items of remote handling equipment for nuclear establishments. They have been designed to answer the need for remote handling facilities in the intermediate range of 10 to 200 lb.

The three items are:

1. Model NE9—a master slave manipulator, stronger than the standard model, intended to manipulate loads in the 8–30 lb range.
2. Model 100—a General Mills' power-operated arm which gives a full range of movements and cell coverage.
3. Model 150—a compact powered mechanical arm, designed by General Mills specially for alpha-gamma handling in air-tight enclosures.

The Model 9 master slave manipulator has been designed and developed by Nuclear Equipment Ltd. in collaboration with the United Kingdom Atomic Energy Establishment to meet the demand for a manipulator to handle heavier weights than the Model 8. Typical uses are the lifting and handling of fuel elements, and the manipulation of valves, clamps and specialised power hand tools.

The handle of the manipulator is of the pistol-grip type, the grip being transmitted by a specially designed roller chain; the jaw mechanism also incorporates a roller chain. It has been built to a specification which specifies limits of friction, torque and lost motion in every movement.

The Model 9 is fitted with the Harwell-type gas sealing, employing a cradle assembly, gas-tight jaws and a p.v.c. gaiter system which can be changed remotely from the operating side of the cell wall without loss of pressure differential.

The Model 100 has been designed to bridge the gap between the master slave and the Model 300 (capacity 750 lb). Control is by a small portable control package. Toggle-type operator switches provide two-speed control for each motion in either direction. A master rotary selector switch provides a speed range change, so that a total of four speeds is available. The control cable connects to a wall or floor mounted power box housing the power components. The required power input to the unit is 2·0 kVA. The arm is powered exclusively by 115 V single-phase motors, all switching being accomplished by a.c. voltages, eliminating rectifiers and d.c. switching.

The arm consists of a forearm assembly, with an interchangeable hand and hook. Three motions are provided, grip, wrist rotation and elbow pivot. Brakes or irreversible drives are used in each motion to ensure against creeping under load, and to obtain fail-safe operation.

The carriage assembly consists of a wheeled platform, telescoping tube assembly and appropriate drives, horizontal travel of the carriage, vertical and rotational movement of the telescoping hoist. All drives are powered by sealed gear motors which are dynamically braked. Irreversible gearing holds the load and prevents creeping. The carriage platform has four flanged wheels mounted on sealed anti-friction bearings to guide it along the bridge. Friction drive is provided by a gear motor driving two of the wheels through a sprocket and chain.

The Model 150 mechanical arm is a compact manipulator for both precise manipulation or routine material transfer functions. It can be mounted on a conventional overhead bridge, or on a boom, or it may be suspended from the ceiling of a dry box. Control of this model is also by a small portable control box. On-off push-buttons and individual lever action switches provide direction and infinitely variable speed controls for each motion.

A cable connects the control box to a wall or floor mounted control centre via a cell window junction box. The control centre houses power components, consisting of transformers, rectifiers, reactor units, relays and circuit breakers. The required input to the unit is 1·0 kVA at 115 V, 60 c/s. The arm is powered entirely with direct current shunt or permanent-magnet field motors for nearly constant torque output. Infinite speed variation within the motor speed limits is obtained by varying the magnetic amplifier output to the motor armatures. Direction of motor rotation is accomplished by switching the current flow in the armature.

Six motions are provided: grip, wrist, elbow and shoulder bending, and rotation of wrist and shoulder. Totally enclosed d.c. gear motors mounted on the forearm housing open and close the hand and rotate it about the wrist axis. The remotely removable hand is a parallel jaw, rack and gear assembly. A lead screw rotated by gears and a gear motor drive the rack to produce the grip motion. A spring incorporated in the system provides for a soft grip on fragile objects.

Circle **69** *for further details.*

Pulse Switches

A SWITCH which will produce one square wave pulse regardless of the speed of switch operation has been introduced by Honeywell Controls Limited.

Known as the "One-Shot", it consists of a precision single pole double throw micro-switch with a capacitor, resistor, magnetic core and diode.

Operation of the switch charges the capacitor through the normally open circuit; this switches the square loop core which produces an output pulse to the load. Release of the switch discharges the capacitor and resets the core; the negative voltage produced is blocked by the diode. In the normal (unoperated) condition, the circuit is isolated from the power supply and there is no power drain during standby.

All components in the circuit package are potted for physical and environmental protection; the switch will operate in ambient temperatures between −65 and 185°F.

Six "One-Shot" circuit packages are available, each one designed for specific pulse width, ranging from 0·1 to 10 microseconds. These assemblies can produce voltages up to 180 V and drive loads as low as 5 ohms. They are available with push-button or toggle actuators.

By providing a pre-engineered compact package, measuring only 2½ in. overall, the "One-Shot" eliminates time consuming circuit development otherwise necessary to accomplish a shaped wave output.

Circle **70** *for further details.*

Helium Leak Detector

INDUSTRIAL INSTRUMENTS INC. have developed a miniaturised gas analyser, calibrated to indicate directly the helium concentration in air.

A dual range meter scale coupled with a high sensitivity detector permits quick and precise location of either small or serious helium gas leaks in tanks, piping and fittings.

Two models are available—fully portable with a hand-operated rubber aspirator and a model using a small 115 V a.c. operated vibrating reed pump to draw the gas for scanning through the detector. Both models are housed in a 6 × 8 × 5 in. metal case. Total weight is approximately 9 lb including the 5 ft wand and "long life" mercury cells.

The instrument is available through the U.K. agent G. Mellor Ltd.

Circle **71** *for further details.*

6/10/15 Watt Indicator Lamp Assemblies

A NEW range of 6, 10 and 15 watt indicator lamp assemblies, suitable for panel mounting, are announced by the Components Division of Lancashire Dynamo Electronic Products Limited, Rugeley, Staffs. These indicators offer a number of new features to industrial users and, as an alternative to the standard glass retaining bezel, can be supplied with a solid guard ring to protect the glass from damage.

A particular feature of the new 6/10 watt range consists of terminations which have been evolved to save installation cost and this provides the facility for slide-on terminals, and, as an alternative, soldered connections. The S.B.C. holder is also suitable for printed circuit applications and is available as a separate component item.

Circle **72** *for further details.*

Kappa Moisture Meter

THE Kappa Model AB/55 moisture meter is a frequency-sensitive device that measures, in arbitrary units, the permittivity of the contents of a removable test cell, the permittivity being dependent upon the physical properties and moisture content of the material. A change in frequency produced by a variation in the moisture content of the sample is accurately detected by a superheterodyne circuit and is indicated on a continuous scale that is calibrated in 1,000 well-spaced divisions.

The frequency of the test circuit is selected so that readings are not affected by conductivity and a choice of cell size ensures that the sample is truly representative of the bulk.

For normal materials of reasonably constant composition and texture, the accuracy can be expected to lie within 0·05–0·4 in the 0–20%; 0·2–0·5 in the 20–30%; 0·3–0·7 in the 30–40%; and 0·5–1·0 in the above 40% moisture range.

The instrument is finding wide use in the agricultural, food and chemical industries, typical applications being the determination of moisture content of grain, cork, tobacco, cocoa, coffee, tea, sugar and biscuits.

Circle **73** *for further details.*

Moisture meter Model AB/55

Computer Techniques in Echo-sounder

THE use of computer techniques has made possible a new method of presenting echo-sounding information to the navigator in the "Metron" depth meter produced by The Marconi International Marine Communication Co. Ltd.

In the "Metron" the depth of water beneath the ship on which it is fitted is indicated by a pointer on a graduated circular scale, a glance at which suffices to show the navigator the sounding at any given moment. The reading shown is the actual depth at the time of each individual sounding, and not, as in somewhat similar systems, an average over the period of several soundings. The frequency of "Metron" soundings is approximately one per second, so that any sudden change of depth is shown within a second of its taking place.

The scale is calibrated in two ranges covering 14 to 180 feet and 14 to 180 fathoms, with positive neon-light indication of the range in use. Graduations at the lower end of the scale are well spaced for accuracy in reading shallow soundings. A supplementary cursor, adjustable by use of a knob in the centre of the dial, can be set at the last significant reading for the purpose of checking any appreciable changes in depth.

A complete "Metron" installation consists of four principal units—the display meter itself, the amplifier integrator, the transceiver, and a control switch, with, of course, the necessary projector assembly. Operation may be direct from 115 V, 50–60 c/s a.c. mains, or through a rotary converter from d.c. mains of 110 or 220 volts.

The amplifier integrator is a simple form of computer which selects the signal received back from the sea-bed at each sounding and applies the appropriate voltage to the display meter.

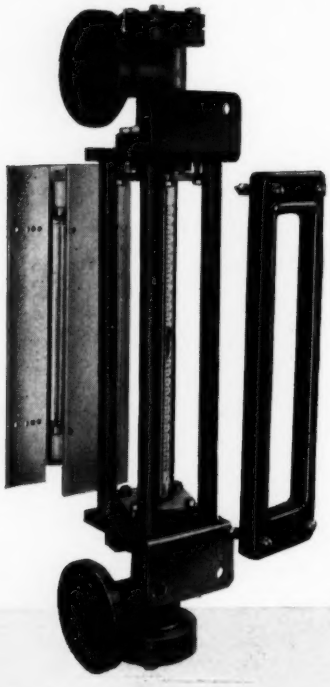
The transceiver employed is that designed for the high-power "Seagraph III" recording echometer, and in fact it is anticipated that much of the demand for the new "Metron" will be for installation with the "Seagraph III" in both new and existing fittings, as in this way owners will be able to take full advantage of the fact that one single transceiver will operate either the "Seagraph III" recorder or the "Metron" to provide a choice of recorded or instantaneous meter indication.

P. & O. Orient Lines have had "Metron" installed on several other vessels, including the new passenger liner *Oriana*.

Circle **74** *for further details.*

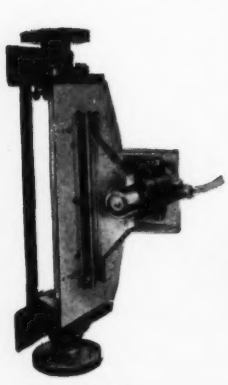
Circle 165 for further information

Special Purpose Equipment for METRIC ROTAMETERS

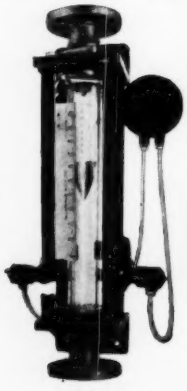


The Metric Series of Rotameters is a range of flowmeters for liquids and gases designed to withstand rough industrial usage and yet fulfill a useful function in short term pilot plant or laboratory work. Interchangeable tubes and floats and gland packings (incl. P.T.F.E.) for a given size together with rationalisation of components and installation dimensions are the great benefits of this series. Of particular interest are the various items of supplementary equipment shown here which further extend the scope of the series.

Full technical information is available on request.

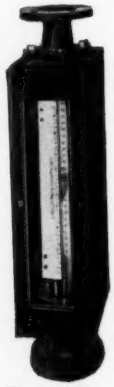


Illuminator



Alarm

Type 102



Type 917

Alarms
A photo-electric alarm to signal fluid flow above or below desired limits. Several alarms may be fitted to one instrument. The alarm will fit any size of Type 907 or 914 instrument and may be installed without interrupting plant operation.

Illuminators
Illuminators (including a flame-proof model) are available for meter Types 907 and 914. One size of illuminator fits any size of frame, and may be installed while the instrument is operating.

Bezels
Glazed bezels for flush panel mounting may be supplied. In the case of Types 907 and 914 they are fixed independently of the meter.

Flow Scales
Flow scales can be provided for any fluid or flow units. (Scales can also be produced by the user.)

Calibration Charts
A series of charts is available that enables the user to prepare his own flow scales for any fluid having known characteristics.

Glass Flanges (Type 102)
Tubes are held in stock welded to glass flanges to B.S.2598, for corrosive service. Sizes 7 to 10 inclusive have spiral wire float stops, larger sizes have glass stops. Wire stops are normally stainless steel, but other appropriate metals (e.g. tantalum) can be fitted. Clips can be provided to attach the flow scale to the tube.

Type 917 Chassis
This is a permanently enclosed and virtually gas tight chassis designed for use under dangerous conditions. Provision is made for venting to safe atmosphere, and for flush panel mounting.

ROTAMETER
FLUID MEASUREMENT AND CONTROL
FLOW-DENSITY-LEVEL
M45/568

ROTAMETER MANUFACTURING CO., LTD.,
330, PURLEY WAY, CROYDON, SURREY
Telephone: CROydon 3816. Telex.: 24292

NEWS OF THE INDUSTRY

INSTRUMENTS

MURPHY RADIO LTD., Electronics Division, have received **Board of Trade approval for a new electronic system for continuous weighing** of belt conveyed solids. This is the first electronic pattern to receive Board of Trade approval for inventory weighing. Transweigh has many applications, particularly in the automatic control field in the steel and chemical industries, power generation, ship loading, and heavy materials handling.

The Transweigh patent is based on a short weighing carriage utilising a resistance type load cell which senses the weight of material on the conveyor belt. Belt speed can be measured by a selsyn system or by a tacho-generator, depending on the application. Minute movement of the weighing carriage affords accurate measurement of belt loading and minimises wear.

A millivolt d.c. signal from the load cell is fed to a potentiometric servo amplifier, which positions the ball on the disc of a ball and disc integrator housed in the E2 unit. Belt speed is transmitted to the disc by a selsyn system, and these two variables are therefore continuously integrated.

A THIRD **six-point combustible gas alarm** has been supplied by Mine Safety Appliances Co. Ltd. for the engine laboratories of Esso Research Ltd., Abingdon.

The sampling points are installed in the test bed cubicles and along the length of the fuel distribution systems. Continuous monitoring is required in order to detect the presence of fuel vapour within these enclosed areas should pipeline leaks or fractures occur.

Each C.G.A. samples from six different points and is set to raise a visual and audible alarm should the concentration of vapour at any of these points exceed one tenth of the lower explosive limit. Design of the instrument control panels was specified by Esso for mounting with banks of other instruments in the main engine laboratory.

ENGINEERS of Aramco, the Middle East oil company, have carried out final acceptance tests on a **40-point temperature scanner** at the Honeywell Controls Ltd. factory.

The unit will watch bearing temperatures of a gas turbine compressor in an L.P.G. plant at Abqaiq pumping station in Saudi Arabia.

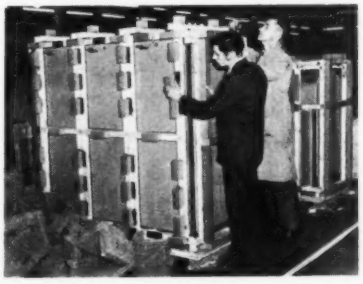
If during 1-point-a-second scanning a point is found overheated, a klaxon sounds, the scanner stops and the jack of the appropriate point indicated on a Nixie lamp display is plugged. This connects a precision indicator and individual measurement can be made while scanning resumes.

A second plug connects any desired point to a strip chart recorder in the panel.

FOLLOWING the recently-announced order for Waymouth **fuel contents measuring equipment** for B.O.A.C.'s Vickers VC.10 aircraft, Smiths have received an order for similar equipment for the 24 DH. Trident three-jet, short haul transports now being built for British European Airways.

As in the case of the VC.10, the Trident will have a development of the basic Waymouth Type 4 transistorised fuel contents gauge, which again incorporates facilities for the accurate control of fuel load during ground handling of the aircraft.

A National-Elliott E32X line printer—comprising 10 large cabinets, motor generator, printer and hundreds of small electronic units—was packed recently at Boreham Wood, Herts., to a specification prepared by Hairlok Laboratories Ltd. Worth approximately £100,000, the line printer is destined for the National Cash Register Co., Sydney, Australia, where it will be linked to a computer exported from Britain 18 months ago.



Expanded rubber blocks are affixed to a crate frame surrounding the thyratron cabinet. Also in a crate frame (right) is the line printer. In the left foreground are corner blocks of rubberised hair used for protecting many of the primary cases. The entire packaging operation was planned and supervised by Hairlok Laboratories Ltd.

STILL further improvements in the trigger **characteristics of silicon controlled rectifiers** are announced by the Electronic Apparatus Division of Associated Electrical Industries Ltd. In September the maximum trigger current required to fire any rectifier was reduced from 350 mA to 150 mA; it has now been cut to only 100 mA and the maximum voltage required is reduced to 3·75 V (formerly 5 V)

The improvement will especially benefit users who wish to employ pulse triggering of controlled rectifiers.

THE fluorocarbon t.f.e. electrical thin wall and super thin wall **sleeving,** manufactured by Polypenco Ltd. has now been fully tested to British Standard B.S.2848, Type 6, Class 250T, and meets the requirements of this standard in full.

In addition, all coloured sleeving in both thin wall and super thin wall ranges is now being produced by Polypenco Ltd. to the British Standard colour coding as specified in B.S.2746.

Polypenco Ltd. announce substantial price reductions in their range of FLUOROSINT shapes.

Polypenco FLUOROSINT is currently available in moulded rod form from $\frac{3}{4}$ in. to 11 in. diameter, moulded tubes in a wide range of sizes from 2 in. o.d. × 1 in. i.d. to 8 in. o.d. × 6 in. i.d., and tape. Small parts may initially be machined from 2 in. long segments ranging from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. diameter.

THE complete range of BURNELL variable inductors, adjustoroids, subminiature and encapsulated toroids, toroids, Tom Thumb telemetering filters, delay lines, crystal filters and related networks are now available from **Aero Electronics Ltd.,** Gatwick Airport, Horley, Surrey, who have been appointed the U.K. distributors for EDO (Canada) Ltd., the Canadian Licensees of Burnell & Co. Inc., California. Catalogues and wall charts are immediately available for interested manufacturers.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LTD. announce that, as a result of large-scale production and improved methods of manufacture, an immediate price reduction is being made on their Series SME.2 **smoke alarm and densitometer equipment.** The equipment is designed to monitor the density of smoke emitted from chimneys as a protection against the infringement of the Clean Air Act.

The Series SME.2 equipment, which was the first of its type to be awarded the British Standard Institution's "Kite-Mark" certifying full compliance with B.S.S.2740 and 2811, is in quantity production and deliveries of basic installations can be made from stock.

SOUTH AFRICAN RAILWAYS, who recently took delivery of an **I.C.T. Type 1202 electronic computer,** have now placed orders for three more machines of the I.C.T.1200 series. The capital value of the total order is approximately £200,000.

The first machine was installed in August of last year at Railway Headquarters, Johannesburg, producing 8,000 salaried pay vouchers in the first month of work. Ultimately it will handle the payroll for 28,000 employees.

Two other I.C.T.1202s, which are to be delivered during 1961, are to carry out similar work at Port Elizabeth and East London. It is intended that ultimately these two machines will be used for an integrated accounting system, combining payroll with stores and costing procedures.

The fourth computer, an I.C.T. Type 1201, also due for early delivery, is to be used for the following tasks: an analysis of goods carried by South African Railways, a ticket audit and the maintenance of the pension records of 110,000 European employees.

THE METAL BOX COMPANY LTD. have placed an order with Ferranti Ltd. for an **Orion data processing system** for installation at their central accounts offices in Worcester. Associated with the purchase of the computer will be **I.C.T. (80-column) equipment.**

Existing staff will be trained in the operation of the new equipment and new routines. It is expected that the reduction in staff brought about by the introduction of the new equipment will be absorbed by the normal processes of staff turnover and business expansion.

ONE of the safety rules applied in the London Midland Region of British Railways is that the rubber gloves worn by personnel dealing with electrified lines and switchgear must be tested every 90 days.

The Dexion-framed glove testing unit

In order to cope with the hundreds of pairs of gloves constantly being put through the test at the Chief Mechanical and Electrical Engineer's Department at Wembley, the Electric Traction Engineer, Mr. G. W. Parkin, and his staff devised this Dexion-framed **glove test tank.** The centre slotted angle structure contains the water tank in which the gloves, which are designed to give protection against 750 volts, are submerged to within an inch and a half of the edge of the gauntlet. The gloves are then filled with water to a similar level. After soaking for an hour each glove is submitted to a 5,000-volt test load for one minute; any leakage through the rubber is indicated by pilot lights. The test rig itself is fitted with safety devices to protect the operators.

The ovens at the side of the tank are for drying the gloves, which are thoroughly washed in a warm detergent solution, before and after testing. The gloves are also checked for other possible defects and are returned for use in virtually new condition.

POLYPENCO LTD. announce the establishment of a new subsidiary company in France to market the range of engineering plastics manufactured at the Welwyn Garden City plant.

The new company, entitled **Polypenco (France) S.A.R.L.** has acquired premises at 91 Rue de Billancourt, Boulogne (Seine), which includes both office and warehouse facilities. The company is under the management of Mr. M. Marion.

A new Polypenco organisation, **Polypenco G.m.b.H.,** was formed in early January in Cologne, Germany. This new company is under the management of Mr. H. Cleinow.

A NEW company, **Shawford Control Gear Co. Ltd.,** has been formed to import into the U.K. from Italy the CEMA range of heavy-duty control units, pilot lights, selectors, pedal switches, palm switches, limit switches, contactors, isolators, timers, latched relays, terminal blocks, solenoids and micro-switches.

Directors of the new company are: Mr. P. L. Norton (Managing), Mr. C. F. Ford, Mr. E. Basan and Mr. D. C. Ambrose.

Elliott Brothers (London) Ltd. announces the formation of a new subsidiary company, Rotron Controls Ltd., owned jointly with The Rotron Controls Corporation of Woodstock, New York. Elliotts have a two-thirds controlling interest in the new company.

Rotron Controls Ltd. will have its headquarters at the Elliott-Automation factory at Airport Works, Rochester, Kent. It will manufacture the range of flowmeters and associated equipment developed by the Rotron Controls Corporation for positive and mass-flow measurements in the oil, gas, water and petro-chemical industries and will sell these instruments throughout Europe, the Middle East and the British Commonwealth (except Canada).

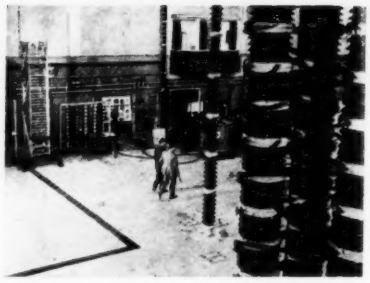
DAVY-ASHMORE LIMITED announce the formation of a new subsidiary, **Davy-Ashmore Export Co. Ltd.,** to manage and develop the overseas selling and engineering organisation and to promote a further extension of the Group's export trade in capital goods.

The directors are: Mr. M. A. Fiennes (Chairman), Mr. D. L. Campbell, M.C. (Managing Director), Mr. D. M. R. Brown, Mr. M. F. Dowding, Mr. T. K. Hargreaves, D.S.O., Mr. C. Robson, Mr. R. W. Rutherford, Mr. H. M. Sutherland, Mr. H. H. Utley. Mr. L. Davis is Secretary.

The address of the new company is 15 Portland Place, London, W.1. Telephone No. Langham 5588.

International Computers and Tabulators Ltd. have made a colour film entitled "Satisfied Users". The film runs for 30 minutes, and shows a selection of the users of the I.C.T.1200 series computer. Applications include production and stock control, costing, payroll production, subsidy calculations and mathematical and scientific calculations.

Among the industries which have benefitted from the use of an I.C.T. computer, and which appear in the film, are crucible



The high voltage insulator test laboratories at Pilkington Bros. Ltd. A "still" from the I.C.T. film "Satisfied Users"

testing, glass production, screw production, farming and sugar beet harvesting.

COMPANIES

To consolidate existing Australian representation and to deal with the growing interest in computers in Australia, the **Computer Department of Ferranti Ltd.** has established a permanent office in Melbourne.

In charge of the office is Mr. W. R. Arnott and with him from the United Kingdom is Mr. Keith Nicol, a mathematician who has been working with computers for some years.

Staff for the office will be recruited in Australia, and a Ferranti Sirius computer will be installed later in the year.

Initially attention will be concentrated on the Sirius and Orion computers.

THE Instrument Division of Newman Industries Ltd., of Yate, Bristol, has been re-named **Newman Electronics—Division of Newman Industries Ltd.**

Mr. Hedley Newman, assistant managing director, said that the company was in the process of expanding the division which is now producing an increasing range of electronic equipment, and the new title is more in keeping with their product range.

ELLIOTT-AUTOMATION LTD. announces that for certain applications joint marketing arrangements have now been arranged between **The Rheostatic Co. Ltd.** and **Black Automatic Controls Ltd.,** both member companies of the Group.

Under these arrangements Rheostatic will sell the wide range of Black solenoid-operated valves, pressure and flow switches to the heating, ventilating and air conditioning industries under the name "Black-Satchwell', along with its own well-known range of Satchwell controls. In future also the Rheostatic Co. will, as appropriate, include "Black-Satchwell" controls when offering comprehensive control schemes for these industries and to manufacturers of gas and oil-fired boilers.

At the same time Black Automatic Controls Ltd. is opening a sales office in London at Steel House, 11 Tothill Street, London, S.W.1. (Whitehall 5814-5.)

THE second stage in the erection of the new factory at Chessington for the

Solartron Laboratory Instruments Ltd., the electronic instrument manufacturing company of the Solartron Electronic Group, Farnborough, Hants, is now under way.

The administrative block of 25,000 sq. ft, which presently houses the instrument sales and the international division of Solartron, was occupied early in 1960. Also in this block are the instruments servicing and works training sections, together with some production facilities.

The second section of 50,000 sq. ft being built will be completed in October, 1961, and the third stage—a further expansion of 50,000 sq ft, for which the Chessington site has available space—will be completed in three years' time.

WORK is now well advanced on another large modern building at the **Cambridge Instrument Company's** factory in Chesterton Road, Cambridge.

The new building, which will be similar in appearance and joined at one end to the company's new research laboratories, will consist primarily of two floors supported at first floor level by a series of reinforced concrete pillars. The top floor will house testing, assembly and wiring departments, and the first floor will be devoted to enlarged production space for the company's Microscan X-ray analyser and to works offices. The area beneath the first floor will be almost wholly taken up by parking space and a loading bay with gantry and platform. An important feature is a double-decker bridge that will connect the building to existing production departments and provide additional space for a calibration room and cloakrooms.

The building, which is expected to be ready for occupation in July, adds 16,000 sq. ft of floor space to the 20,000 sq. ft provided by the research laboratories, which were opened by Lord Adrian in October, 1959. The mode of construction will give a clear area on all floors uninterrupted by columns or beams, and extensive use is being made of new materials and techniques. In addition, the building will be fully air-conditioned in order to provide a high standard of cleanliness and the best possible conditions for those who will work there.

A £55,000 building affording a large increase in laboratory and workshop facilities for **Nuclear Enterprises (G.B.) Ltd.,** of Edinburgh, was started on a new two-acre site within the Sighthill Industrial Estate in mid-February. This is the second sizeable expansion within two years, and the new premises will provide accommodation for 250 employees. The initial development will cover 25,000 sq. ft, with 16,000 sq. ft allocated to laboratories and workshops, and 6,500 sq. ft to a two-storey administration block, but the site chosen will allow for a further expansion of 50,000 sq. ft.

ADDITIONAL factory premises in Wimbledon, S.W., have been acquired by the **British Rototherm Co. Ltd.,** Merton Abbey, London, S.W.19, the scientific instrument makers.

The Wimbledon works, which are in the course of being equipped with the most modern plant, will accommodate a machine shop, dial thermometer production unit and bulk stores.

MR. J. R. MCNALLY, general manager of the Glenrothes factory of **Beckman Instruments Ltd.,** has been visiting major electronic dealers in Paris, Brussels, Amsterdam, Milan, Rome, Turin, Genoa, Geneva and Zurich as part of the company's selling programme for 1961.

At home Mr. E. W. Shepherd has been appointed as sales manager. Mr. Shepherd was general service manager of the E. K. Cole Group at Southend-on-Sea for a number of years.

To handle the expected increase in business, resulting from his European trip, Mr. McNally will shortly open the new London Sales and Service Office of Beckman Instruments Ltd. at 5/6 Nigel Playfair Avenue, Hammersmith, W.6.

MANY apprentices of **George Kent Ltd.** received awards presented by the company chairman, Commander P. W. Kent, R.N., at the firm's annual Apprentice Prize-Giving and Exhibition of Work held recently at Biscot Road Works, Luton.

Guest speaker for the occasion was Mr. W. F. Stephenson, B.Sc., F.R.I.C., principal of the Luton College of Technology. In his address Mr. Stephenson emphasised industry's growing need for qualified technical specialists and therefore the great importance of theoretical studies, but also made reference to a recent Government White Paper outlining the parallel opportunities available to those more suited to specialist careers of a practical nature.

The varied selection of apprentices' work on display provided ample evidence of both theoretical knowledge and skilled craftsmanship.

Mr. Norman Turner presenting a gold watch to Mr. George Stone, one of the ten new members of the Ernest Turner "25" Club

London Dial Co. Ltd. have moved to new works at 113 Regent's Park Road, London, N.W.1, thereby increasing their capacity. Owing to the increasing number of enquiries in regard to Government-sponsored items among their range of luminised and fluorised dials, pointers, etc., they had felt it necessary to apply for D.G.I. approval and this has now been granted to them under Certificate No. 11200.

THE telephone number of Chronos Works, Head Office of **Smiths Industrial Division,** is now GLA 6444.

Hatfield Instruments Ltd. and **Balun Ltd.** have now moved to Burrington Way, Plymouth, Devon, the sales manager, Mr. A. L. Williams, will continue to operate from the London area.

THE telephone number of **Simms Motor and Electronics Corp. Ltd.** has been changed to FINchley 2692.

THE Scottish organisation of **Philips Electrical** have moved into their new regional headquarters at Highland House, Waterloo Street, Glasgow.

AGENTS

Telemechanics Ltd. have recently appointed Electronic Development and Applications Ltd., P.O. Box 1905, Auckland, C.1, New Zealand, as agents for the sale of their products in New Zealand.

Goodmans Industries Ltd. have now established three main agencies in the United Kingdom to handle their vibration test equipment on a sales and service basis, the agencies are:

Midland Area:	Messrs. Hawnt & Co. Ltd.
Northern England:	Farnell Instruments, Wetherby
Scotland:	A. R. Bolton & Co.

Continental Distributors Ltd. have been appointed U.K. agents for **Alderson Research Laboratories,** Long Island City, New York, U.S.A.

Alderson Research Laboratories are manufacturers of a range of radiological test phantoms and anthropomorphic test dummies.

Continental Distributors have also made an agreement with **Sansar,** Elettronica Per Fisica Nucleare, 225 Viale G. Suzzani, Milan, Italy, for the sales and servicing in the U.K. of their automatic bi-dimensional radiochromatogram scanner.

THE sales and service of Ampex Videotape recorders in the United Kingdom, and Northern Ireland, which have previously been carried out by Rank-Cintel Ltd., will now be handled by **Ampex Great Britain Ltd.** This change is a result of the establishment of an Ampex subsidiary in England, and is made by mutual agreement between the two companies.

Ampex engineers will continue to give to users of their Videotape equipment the services previously provided by Rank-Cintel.

AGREEMENTS

AN agreement has been reached between **Microcell** and **Emerson and Cuming Inc.,** of U.S.A., for the sale and distribution in the United Kingdom of the American company's range of plastics designed specifically for the electronic industry.

The responsibility of covering Britain will be undertaken under the agreement by Microcell's Electronics Division.

The Wayne Kerr Laboratories Ltd. have now reached the final stages in negotiations for a licensing arrangement with **Gertsch Products Inc.,** precision

electronic instrument manufacturers, of Los Angeles, U.S.A.

Mr. Richard Foxwell, managing director of Wayne Kerr, said that if negotiations were successful, it would mean that many of the wide range of Gertsch instruments would be available in the U.K. from Wayne Kerr and that the agreement provided an opportunity to immediately extend the range of Wayne Kerr measuring instruments using the transformer ratio arm technique.

Lancashire Dynamo Electronic Products Ltd. has concluded a licence agreement with the **Emerson Electric Manufacturing Co.,** of St. Louis, Missouri, under which the American company will have the right to manufacture in the United States on a royalty basis the complete range of industrial electronic control equipment which has been designed, manufactured and marketed by the British company over the past fifteen years. The agreement provides for a continuing flow of "know-how" to Emerson on new developments in equipment and manufacturing techniques.

Among products covered by the agreement are a complete range of specialised adjustable speed drives for all types of industrial process, regulator equipment, circular and strip chart recorder/controllers for the process industries, machine tool control systems, a wide variety of photo-electric equipment, resistance welding controls and many other specialised devices for automatic control in industry.

The Emerson Electric Manufacturing Co. have for many years been a major producer of military electronic equipment and associated mechanical devices for the U.S. Government. Their interest in the guided missile field is closely associated with the Honest John and Littlejohn missiles and with heat resisting compounds for nose cones and similar applications. In addition, they are a leading supplier of small electric motors, air-conditioning systems, industrial and domestic lighting fittings and products for electrical installations in the home.

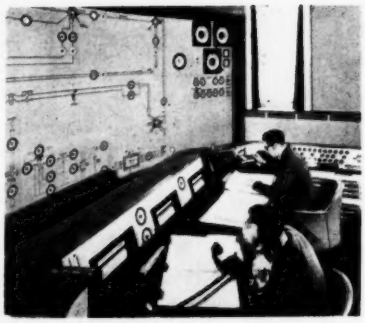
The agreement, in addition to providing for the flow of "know-how" to the U.S. company, also covers a reciprocal flow of similar information in respect of advances in the design of the equipment covered by the licence.

Under the agreement, arrangements will be made for the exchange of personnel between the two companies for training purposes. In the initial stages it is anticipated that specialised parts will be exported to the U.S. for incorporation in complete equipments.

CONTRACTS

ELECTRONIC equipment to be used for research into the causes of turbine blade failure in steam turbine generating plant is to be supplied to the Central Electricity Generating Board by **Bristol Aircraft Ltd.**

The contract—the latest to be gained under the company's programme of offering to industry specialised consultative, design and engineering services based on its extensive experience in electronic instrumentation—provides for the purchase by CEGB of a specially-engineered



This area Control Centre at Redbourne (Herts.), one of the seven new C.E.G.B. centres using standardised equipment, incorporates Honeywell strip chart recorders, mounted in the control desk to give operators the overall picture of the grid supply in the area. Indicators (top right) show actual measurements. Diagram on wall panel includes Cirscale meters for individual power transfer measurements.

vibration test equipment package and the hire of certain telemetry and other data processing equipment. It is hoped that a second order will follow in due course.

Basically, the electronic package to be supplied to CEGB is a refined and developed version of equipment originally designed for Bloodhound guided weapon test programmes. To allow installation inside the turbine shaft, a higher degree of transistorisation has been introduced.

AN order for several thousand axial flow blowers for the West German army is announced by **Plannair Ltd.** This order, the value of which runs into six figures, was received by the company's associates in Munich, Luftfahrtgeräte-Vertrieb Gauting, G.m.b.H., in association with Société Air Equipment of Asnières, Plannair licensees in France.

The blowers are Type 4PL121-174, measuring 9⅜ in. long. They operate from 28 volts d.c. and deliver 130 ft³/min at 2·25 in. w.g.

SKYLARK high-altitude research rockets, launched from Woomera, Australia, broadcast signals back to earth concerning ultra-violet radiation and soft X-rays from the sun, stars and space; and the conditions of ionisation in the upper atmosphere—its temperature, concentration and character. These data, transmitted in analogue form, are recorded on magnetic tape.

The Physics Department of University College, London, has placed an order with **E.M.I. Electronics Ltd.'s Telemetry Division** for magnetic tape data processing equipment which will accept analogue telemetry data recorded on magnetic tape, and convert them into digital code punched paper tape, suitable for use on computers at London University.

The E.M.I. equipment will process in ten hours a 3,000 feet reel of magnetic tape which would need three people working for three weeks to process manually.

Although the equipment is primarily intended for processing Skylark telemetry data, it has been designed with a high degree of flexibility, so that relatively small modifications will enable it to accept telemetry information from other sources.

Cawkell Research and Electronics Ltd. have received a development contract from the Atomic Energy Research Establishment at Harwell to investigate new methods of recording waveforms, with a view to achieving greater accuracies than was obtained with the oscilloscopes supplied for the Zeta project.

Davy and United Engineering Co. Ltd. have secured a contract to build a 32 and 57 × 98 in. 4-high reversing hot breaking down and plate finishing mill for the works at Chippis, in Switzerland, of A.I.A.G., Aluminium-Industrie-Aktien-Gesellschaft.

The new mill will be capable of producing aluminium plate up to 7 ft 6 in. wide and down to ⅛ in. minimum thickness.

The value of this contract exceeds £500,000.

THE first contract in Britain for one of the new **IBM 3000** punched card accounting systems has been signed by **Unwin Brothers Ltd.,** of Woking, the book printers. It will be installed in the autumn of this year, and will be used for a number of applications, on none of which more than four people are at present employed. These applications include payroll, stock control, costing, machine loading and ledger work.

EXPORTS

A MEETING in London recently of over 130 export managers and senior executives of the electrical industry, with exports already approaching nearly £300 million, welcomed the suggestion that their trade association, BEAMA, should make immediate arrangements to put firms in touch with makers of complementary equipment with a view to **co-operation in electrical exports,** by means of joint sales efforts, joint market research and collective exhibitions overseas.

The first step will be the completion of a confidential questionnaire by each of the firms represented—ranging from the smallest electric switch to the largest power station plant—which will enable the association to bring together firms wishing to co-operate in export promotion. In replying to the questionnaire, the firms will give details of the products they wish to export, the overseas territories in which they would like to co-operate, any existing overseas facilities they would be prepared to share and whether they would like to co-operate with firms in other industries.

Representatives at the meeting drew attention to the many advantages of pooling resources in the most competitive markets, bearing in mind the high cost of maintaining fully trained and experienced sales engineers abroad. There was also a suggestion of sending to overseas territories, including countries behind the Iron Curtain, small teams representing groups of manufacturers.

Several of the largest firms in the electrical industry offered to provide help to smaller firms manufacturing complementary products, by sharing their overseas facilities.

Electrical and allied products represent about one-tenth of all British exports of manufactured goods.

THE European Community for Atomic Energy (Euratom) has purchased a **PACE analogue computing system** for the European Division of Electronic Associates, to equip its research centre at Ispra, Italy.

This computing facility consists of two expanded 231R machines, featuring a total of over 200 amplifiers, with associated non-linear equipment. Costing about $375,000, the system will be equipped with ADIOS (automatic digital input output system) permitting automatic setting of the potentiometers by means of punched tape.

ORDERS have been received by Blackburn Electronics Ltd. for **data logging equipment** for export to Belgium and Iran.

The Belgian order, a substantial one, has been placed by Société de Traction et d'Électricité, consulting engineers for a new power station being built at Mol, near Brussels, where the Blackburn data logging equipment is to be installed.

The equipment is for checking 130 different readings–temperatures, pressures, etc.

The other important order for data logging equipment was placed with the Company by Rendel, Palmer & Tritton, of London, consulting civil engineers in connection with a project for the National Iranian Oil Company, Abadan.

This equipment is for automatically monitoring temperatures on pumping motors at an oil pumping station at Abadan, and is designed to give immediate warning if any temperature rises beyond pre-determined limits.

Digital data recording equipment ordered a few months ago for the National Electronics Corporation of Israel has now been despatched.

EDUCATION

THE Council of Industrial Design is organising a **design appreciation course** for senior engineers. It will be held from 25th to 28th April inclusive and should not, of course, be confused with the third junior course which finishes early in April.

The senior course will have three main aims—to impart an appreciation of design in its widest context, to show how industrial design can be put into practice, and to emphasise the growing application of industrial design in engineering today.

Particular attention will be paid to organisational questions as well as to general design appreciation, so the course should be of special interest to senior engineering staff with executive control or responsibility for engineering design teams.

The course will be held in London and will be residential so as to make the fullest use of available time and encourage group discussion.

FOURTEEN young **apprentices** have come **from Ghana** for advanced technical training under arrangements made between Ghana Airways and Bristol Aircraft. Some of the apprentices will be undertaking a two-year course designed to qualify them as electrical, instrument and radio engineers. The others will be undertaking a four to five year course leading to The Diploma of Technology. They will then return to Ghana as technical officers.

SERVICE

MANY manufacturers of dielectric materials find that electrical checks are required for the development and quality control of their products, but are unwilling to undergo the considerable expense of buying and maintaining Grade I equipment and training engineers in the specialised measurement techniques required.

The Microwave Measurement Section of **Microcell Electronics** have expanded their facilities in order to provide a **measurement service for industry.** Accurate values of dielectric constant, loss tangent, impedance and attenuation can be provided, with a 24-hour service if necessary.

Similar measurements have been carried out on research and production materials supplied by the Plastics Research and Development Laboratories of Microcell Limited over a number of years and considerable experience in this type of measurement has been accumulated.

VISIT

AT the invitation of the Ministry of Aviation, technical experts from a number of European countries attended a series of meetings and visited establishments associated with Britain's **satellite launcher** proposals recently. Among the establishments visited were de Havillands at Stevenage and Hatfield, and the engine and test facilities at Spadeadam, managed by Rolls-Royce Ltd.

During the recent meeting in London of the International Electrotechnical Commission Working Group on Signal Generators, the members visited the St. Albans works of Marconi Instruments Ltd. They are seen here discussing a new Marconi signal generator covering the frequency range 10 kc/s to 72 Mc/s.

RESEARCH

IN connection with the work of the conference on nuclear test control at Geneva, the Government recently announced their intention of carrying out a **programme of seismic research** bearing on the detection and identification of underground nuclear explosions. This programme is now being planned in detail by the U.K. Atomic Energy Authority and suitable areas for the siting of seismic measuring instruments are being investigated. As stated in the House of Commons on 30th July, 1959, the research programme will involve the firing of conventional explosive charges but no nuclear explosives will be used.

Some of the firings will probably take place in disused mines and quarries: others may take the form of charges dropped at selected points in the Channel from Naval vessels.

An operational centre for seismic work is being established at a converted country house a few miles from Aldermaston.

EXHIBITIONS, CONFERENCES, ETC.

A **Conference on the Condensation of Superheated Steam** will be held on Tuesday and Wednesday, 14th and 15th March, 1961, at the National Engineering Laboratory, East Kilbride. It will start at 11 a.m. on 14th March, for the benefit of people travelling from England by air, and the formal sessions will end at lunch-time on 15th March. Opportunities will be provided for those attending the conference to visit the Heat and other laboratories at NEL during the afternoon of 15th March.

For many years, engineers have argued about the effect of superheat on heat transfer from condensing steam. Some assert that superheat has a bad effect, and install desuperheaters in process plant. But others are unable to understand how such an effect can arise. When steam is used at higher pressures for power generation, it is now common practice to heat the boiler feedwater with steam bled from the turbines. Such steam may be superheated enough to make it possible to heat the feedwater above the saturation temperature of the steam. Although feedheaters are now being designed for such "negative terminal temperature difference" operation, many designers admit to feeling their way; authoritative design data are lacking.

The National Engineering Laboratory is working on the feedheater problem, and is considering extending this work into the process field. The conference at the Laboratory will thus serve both to make clear the existing state of knowledge in this controversial field and to ensure that the work at NEL will embrace those aspects of the problem of most interest to industry. Much of the time will, it is hoped, be occupied by informal discussion, but a few papers will be presented to stimulate discussion. These include a survey of the existing state of knowledge as shown in published work, presented by NEL, papers by Mr. J. L. Gray, of the Central Electricity Generating Board, and Dr. R. S. Silver and Dr. H. Simpson, of Messrs. G. & J. Weir, and two short papers by NEL describing the experimental feedheater rig which is now being assembled, and a method of using a digital computer for designing feedheaters.

It is emphasised that, although much of the material discussed will inevitably be theoretical, the ultimate objectives are strictly practical. It is hoped that the conference will attract engineers and

others concerned with problems and developments in this important subject.

Further information about the conference may be obtained from:

The Director (Heat Division),
National Engineering Laboratory,
East Kilbride, Glasgow.

THE **Society of Instrument Technology, and The Birmingham Productivity Association,** are holding a One-Day Conference at The Birmingham College of Technology, Gosta Green, Birmingham, on Wednesday, 29th March, 1961.

This conference is aimed at the small to medium-sized manufacturer, and the object is to show the various aspects of instrumentation which will increase productivity profitably.

The lectures will stress:

(a) Increased productivity using the same labour force
(b) Consistent quality of products by controlled measurement
(c) Reduction of scrap during processing by in-line inspection, including non-destructive testing.

To introduce the managements of the manufacturers to instruments, an instrument exhibition has been arranged with the conference, at which instruments which are discussed during the day are exhibited. Potential users will be able to discuss their ideas with instrument experts, and the necessary contacts made for future use. Plenty of hand-out literature will also be available.

THE British and French Governments convened an international conference in Strasbourg on 30th January to consider co-operation between European and Commonwealth countries on the **Development of a Heavy Satellite Launcher.**

The object of the conference was to study the technical and financial possibilities of international co-operation with a view to the development of a satellite launcher utilising the rocket Blue Streak, capable of putting heavy satellites into orbit, and the development of a first series of satellite test vehicles as a preliminary to the possible exploitation of satellites for various uses.

The co-operative venture envisaged would not be concerned in any way with the military use of launchers or satellites.

The scope of this co-operation would complement but not overlap the activities of the projected European Space Research Organisation.

Joint invitations to the conference were issued to the following European countries: Belgium, Denmark, the Federal German Republic, The Netherlands, Italy, Norway, Spain, Sweden, Switzerland and Austria.

Mr. Thorneycroft, the Minister of Aviation, was the chief British representative at the Strasbourg conference.

TRADE between the German Democratic Republic (East Germany) and the West has shown a marked increase in recent years, and the **Leipzig Spring Fair** which opened on 5th March provided opportunities for further development.

In the first half of 1960 East Germany's foreign trade turnover with non-communist countries in all continents increased by 15 per cent compared with the first six months of 1959. Big increases with European countries included Britain, 52%, Belgium, 79%, Italy, 69%, Austria, 50%, Finland, 45%, and Holland, 28%.

About 200 British firms are taking part in the Fair, taking an area of nearly 65,000 square feet for their exhibits.

LOUGHBOROUGH COLLEGE OF TECHNOLOGY are holding a **Symposium on the Applications of Analogue Computers** on 10th and 11th April.

The first day will be devoted to introductory lectures on analogue computing techniques and on the second day specialist lecturers from industry and computer manufacturers will discuss applications of computers in various industries, and future trends. Members may enrol for either of the two days. The application form for admission to the course is obtainable from The Department of Electrical Engineering, College of Technology, Loughborough, Leicestershire.

THE Minister of State, Board of Trade, Rt. Hon. Frederick Erroll, M.A., M.I.E.E., A.M.I.Mech.E., M.P., will open the **Tenth Electrical Engineers Exhibition** on Tuesday, 21st March, 1961, at 12 noon.

Before his appointment as Minister of State, Mr. Erroll, himself a qualified electrical engineer, was a director of several engineering and mining companies.

THE **Soviet Trade and Industry Exhibition** will be held at Earls Court, London, from 7th to 29th July. It is being organised by agreement between the U.S.S.R. Chamber of Commerce and the Association of British Chambers of Commerce. The aim of the exhibition is to present a comprehensive picture of the Soviet people's achievements in the fields of economy, culture, life, science and technology.

Exhibits will be shown of the latest developments in electronics, optics, atomic energy, and space flights, including computers and programmed machine tool control. The stands will all be manned by Russians who will be willing to discuss the performance and other aspects of the exhibits.

THE **Third International Congress on Cybernetics,** organised by the International Association for Cybernetics, will be held at Namur from 11th until 15th of September, 1961.

The programme is arranged in five sections as follows:

1. Principles and methods of cybernetics
2. Semantic machines
3. Automation: technical aspects
4. Automation: economic and social aspects
5. Cybernetics and life.

Those wishing to present a paper to the Congress should write to the Secretary, Association Internationale de Cybernetique, A.S.B.L., rue Basse-Marcelle, 13, Namur, Belgium.

MANUFACTURERS' LITERATURE

Automatic Weight Control

Data Sheet AW, Issue 4, from Elcontrol Ltd. describes the new LC4 trip point controller and LC5 trip point controller plus margin indicator. These have been designed to give reliable control under difficult conditions. The Elcontrol units are primarily controllers, and the control is actuated directly via the amplifier.

Circle **75** *for further details.*

Electronic Counting and Batching

The Elcontrol Ltd. Data Sheet BC, Issue 1, presents information on the company's electronic counting and batching equipment. The range of electronic equipment available includes units which make use of decade stages employing Dekatron tubes, and simpler self-contained batch counting units suitable for speeds of up to 600 per minute. The Elcontrol high-speed batch counter BC1 is of the fully electronic type; the total count is displayed on Dekatrons. The batch counter BC2 functions at speeds of up to 10 counts per second, to a maximum count of 9999.

Circle **76** *for further details.*

Photoelectric Control

Details of the company's photoelectric control equipment are given on Elcontrol Ltd. Data Sheet PR, Issue 3. The photoelectric equipment now available includes an extended range of photoswitches, all of which are actuated by a change in the intensity of light falling on a photocell. Three relay units described are the PR6, a general-purpose photoswitch; the PR7, a quick-acting thyratron-operated photoswitch, and the PRD2, a combined photorelay and delay switch for relatively slow speed conveyor control.

Circle **77** *for further details.*

"Rectifier News"

The June/July edition of *Rectifier News*, published by International Rectifier Corporation, El Segundo, California, gives information on the solar cell power supply of the Tiros 1 weather satellite. The specialised solar cells were supplied to the RCA Astro-Electronic Products Division, Princeton, N.J., who designed and built the satellite. An account is also given of "Silicon Zener Diodes as Filament Voltage Regulators in A.C. Applications", and information appears on Internationa Rectifier "creative specialisation" applied to "Custom Super-power High-voltage Rectifier Elements".

Circle **78** *for further details.*

Shaker Hearth Furnaces

The standard range available from Efco Furnaces Ltd. is described. Details are given of the general arrangement of the furnaces, dimensions, ratings and output.

Circle **79** *for further details.*

Continued on page 357

Circle **166** for further information

He reads it easily...

A clear record of the last two shifts—and the pen already beginning its course on the next chart. In his hand he has the past: on the panel is the present. Arkon Recorders measure gas, air, steam, water and effluent flow, pressure or vacuum, or pressure and vacuum; flows in one inch pipe or 36 inch mains, pressures from 0.1 inches water gauge to 500 lb. per square inch. They give a clear, unmistakable record which you can read like a book, without hesitation and without mistakes. You can leave the chart on for a few hours, a day, or a week—the record will always be there. Easily read, easy to look after, robust enough to stand on the job, Arkon Instruments can help the control of any process—and their accuracy will satisfy even the men in the lab.

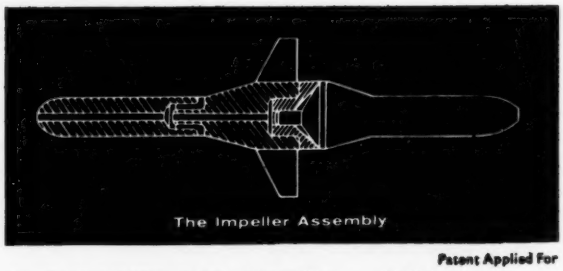
More about Arkon recorders in pamphlet AB 110

WALKER, CROSWELLER & CO. LTD · CHELTENHAM · Tel: Cheltenham 56317

Circle 167 for further information

New British flowmeter

Meterflow Ltd. announce an entirely new range of flowmeters and associated equipment, developed and made in Great Britain. Unique construction utilises the pressure drop across the blades to hold the impeller off the down-stream bearing. This inherent self-compensation of the down-stream thrust, together with spirally cut blades, enable these flowmeters to give the highest accuracy at all speeds, reliability, and long life. The Meterflow range is made of stainless steel and suitable for all corrosive and non-corrosive liquids. Please write or 'phone for full details.



The Impeller Assembly

Patent Applied For

- **Repeatability 0·1%, Linearity ± 0·25%.**
- **Low pressure drop (maximum 3 p.s.i.).**
- **Pipe diameters $\frac{3}{8}$" — 8".**
- **Temperature range −200°C to +300°C depending on bearing material.**
- **Stainless steel throughout—hygienic, non-corrosive.**
- **Most competitive prices.**

Meterflow

Meterflow Ltd *Precision Measuring Instruments*
North Feltham Trading Estate, Feltham, Middlesex
Telephone: Feltham 5876

An associated company with S.E. Laboratories Ltd

PERSONALITIES

Mr. S. A. Clodd, M.I.Prod.E., has been appointed to the board of directors of E. K. Cole Ltd. Formerly works manager and executive director, Mr. Clodd joined Ekco during the war as material controller. He was appointed works manager in 1950 and became an executive director in 1957.

Mr. R. F. Hamman has joined the Manchester sales office of West Instrument Ltd., and **Mr. B. Francis** and and **Mr. R. White** have joined the engineering department at Brighton.

Mr. K. R. Simmonds, B.Sc.(Eng.), A.M.I.E.E., has been appointed managing director of International Rectifier Co. (Great Britain) Ltd.

Mr. Simmonds, who joined the company in September, 1959, as general manager, has been associated with the semiconductor industry for some time, having previously been with Texas Instruments Ltd. as their general manager, marketing. Before that he was manager of the Radar Division at Elliott Brothers (London) Ltd.

Sir Walter Benton Jones, Bt., has retired from the board of Davy-Ashmore Ltd. and **Mr. M. F. Dowding** has been appointed a director. Mr. Dowding is general manager of the Machinery Division of Davy and United Engineering Co. Ltd.

As agreed in principle at the time of the Davy - Ashmore merger, **Mr. C. E. Wrangham,** formerly chairman of Ashmore, Benson, Pease & Co. Ltd. and of P.G. Engineering Ltd., has resigned from the boards of these subsidiaries and **Mr. M. A. Fiennes** has been appointed chairman in his place. Mr. Fiennes is the managing director of Davy-Ashmore Ltd.

Mr. D. L. Campbell, M.C., has been appointed managing director of Davy-Ashmore Export Co. Ltd., the newly-formed subsidiary of Davy-Ashmore Ltd.

Two new sales positions have been created at the M-O Valve Co. Ltd., Hammersmith; **Mr. N. Girton** has been appointed manager, Homes Sales, and **Mr. C. R. Russell** has been made manager, Export Sales.

Mr. Girton joined the company in 1950 and became engineer-in-charge of the u.h.f. and microwave valves manufacturing section. In 1959 he was appointed assistant manager (Home Sales).

Mr. Russell began at the Wembley Research Laboratories, now the Hirst Research Centre, of G.E.C. in 1947 where he has been closely associated with the development of the company's products, in particular with the microwave programme.

Mr. C. F. Barry has been appointed head of the newly-formed Press Relations Department of Industrial Exhibitions Ltd. He will retain his present responsibility for general publicity arrangements.

For the past five years he has been editor of all publications and handbooks for the Instruments, Electronics and Automation Exhibition and all other exhibitions organised by Industrial Exhibitions Ltd.

Mr. E. F. Coppock has been appointed group financial controller to Metal Industries Ltd.

He succeeds Mr. P. Jardine who is taking up full-time directorships with J. G. Statter & Company Ltd. and Minerva Mouldings Ltd., two M.I. subsidiaries.

IBM United Kingdom Ltd. announces that **Mr. Cyril Bottomley** has been appointed the new manager of its Time Systems Division. Mr. Bottomley succeeds Mr. E. Stafford Howard who retires after sixty-five years' service.

George Kent Ltd. have appointed **Mr. Rodney Kent** to be deputy chairman, and **Mr. Walter May** to be assistant managing director of the company; and have also appointed **Mr. John G. Vaughan, F.C.A.,** managing director of the Charterhouse Finance Corporation, as a director of the company.

Mr. Charles F. Dickson, O.B.E., who has been a director of Crompton Parkinson Ltd. since 1939, has been appointed a vice-chairman of the company.

The board of The General Electric Co. Ltd. announces that **Mr. T. B. O. Kerr** has been appointed deputy managing director.

It also announces that **Mr. E. H. Davison** has been appointed financial director of the company. The board of Courtaulds Ltd. agreed to release him from his position as treasurer of that company and he took up his new duties on 1st March, 1961.

A management committee has been formed, the members of which are:

Mr. Arnold Lindley, Chairman
Mr. T. B. O. Kerr
Mr. E. H. Davison
Mr. O. W. Humphreys
Mr. R. N. Millar

Mr. R. C. Archer, sales director of Bourns Inc., California, U.S.A., recently visited Painton & Co. Ltd., the electrical component manufacturers to discuss production and marketing methods. Painton & Co. Ltd., hold the sole manufacturing and marketing rights for the Bourns Trimpot subminiature potentiometers for the whole of Western Europe.

Mr. Archer also visited the Painton associate companies in Belgium and Sweden in company with **Mr. P. J. P. Middleton,** sales manager of Painton & Co. Ltd.

Mr. F. P. Laurens, O.B.E., M.I.Mech.E., assistant managing director (Production) of International Computers and Tabulators Ltd., left London recently for a six-week visit to South Africa.

The main purpose of Mr. Laurens' visit is to discuss current policy matters with the I.C.T. subsidiary, I.C.T. (S.A.) Pty. Ltd.

This subsidiary has rapidly expanding requirements for the company's data processing equipment—both punched card and electronic.

Mr. R. B. Coulson, sales manager of the English Electric Valve Co. Ltd., left London Airport recently for an export sales tour which will include U.S.A., Canada, Australia, New Zealand, Japan and Ceylon. Mr. Coulson will visit representatives and agencies in these countries to discuss ways of increasing the already considerable volume of specialised valves and tubes exported by the company.

Metal Industries Ltd. announces the appointment of **Mr. R. J. F. Howard** as director of marketing. In this new post Mr. Howard will be primarily concerned with the co-ordination of the marketing activities of the electrical companies within the M.I. Group.

Wallace H. Coulter, vice-president of Coulter Electronics Ltd., was the recipient at a ceremony in Philadelphia recently of the John Scott Award consisting of a copper medal, scroll, and 1,000 dollars.

This award, founded by a Scottish chemist in 1816, is presented annually for inventions which are outstanding contributions to science. Past recipients include Orville Wright, Eddison, Marconi, DeForest, Madame Curie, and Alexander Fleming.

The invention for which Mr. Coulter obtained this award is the basis of an instrument (the Coulter counter), which is used extensively in medicine as a blood cell counter and cell analyser, and in industry as a fine particle measurement instrument. This instrument electronically counts and sizes very small particles in the range 0·2 to 250 microns, as they pass through a small orifice. The particles are detected as they pass through this orifice by means of the change in electrical resistance of the path through the orifice.

In the five years since this instrument was first marketed, over 1,500 of them have been sold to hospitals and industrial plants throughout the world.

Mr. Stanley H. Goss has been appointed joint managing director, with Mr. L. G. Oxford, of Firth Cleveland Instruments Ltd. In January, 1960, Mr. Goss was appointed an assistant managing director of Simmonds Aerocessories Ltd., and he was appointed a director of Firth Cleveland Pumps Ltd. when that company joined the Firth Cleveland Group in 1959.

Mr. Ll. Young, M.I.Mech.E., M.I.Mar.E., M.Inst.F., has been appointed director of Bailey Meters and Controls Ltd., as from 12th January, 1961.

As and from 1st February, Mr. Young assumed the position of director of engineering and, in consequence, relinquished the position of general manager.

Mr. A. Elliot, A.M.I.Ex., who has held the position of export manager for Baird & Tatlock (London) Ltd., with whom he has served for 23 years, has now been appointed general sales manager of the associated company, W. B. Nicolson (Scientific Instruments) Ltd. Mr. Elliot took up his duties at the head office of W. B. Nicolson (Scientific Instruments) Ltd. in Glasgow on the 30th January, 1961.

Mr. J. E. C. Bailey, C.B.E., managing director of Baird & Tatlock (London) Ltd., Hopkin & Williams Ltd. and W. B. Nicolson (Scientific Instruments) Ltd., left the United Kingdom on the 5th February for a tour of the companies' branches and agents in Africa. Mr. Bailey visited Nairobi, Ndola, Salisbury, Johannesburg, Cape Town and Durban, and returned to this country on the 4th March.

Mr. R. B. Mann, electrical sales engineer with automation and semi-automation background, has joined the Electrical Remote Control Co. Ltd., and will be concerned with their technical advisory service on the application of process timing equipment to industry.

Mr. W. M. Chapman-Walker, C.B.E., M.V.O., M.B.E., has been appointed a director of Aerialite Ltd. Mr. Chapman-Walker has been associated with Aerialite Ltd. as part of their London organisation for a number of years past.

Mr. A. V. Roberts, Grad.I.E.E., Grad.(S.A.)I.E.E., has just returned to South Africa to pioneer an Instrumentation Department for Evershed & Vignoles Ltd., through their agents, British Agencies (Pty.) Ltd. Mr. Roberts attended the Post Graduate Control Course at Cambridge University under Mr. J. F. Coales and subsequently gained considerable experience with Evershed & Vignoles Ltd. whilst on a two-year F.B.I. Scholarship in Britain.

Mr. C. A. P. Cannon was, in January, appointed to the board of Measuring Instruments (Pullin) Ltd. after 21 years' service with the company. Mr. Cannon was, at the same time, created general manager.

Major William Logan, general sales manager of Avo Ltd., has been appointed to the board of the company and will assume the responsibilities of sales director.

Smiths Industrial Division have appointed **Mr. Haydn Hollyman** as area representative for the Midlands, to replace the late Mr. V. P. Scholes.

He will be responsible for the sales of boilerhouse and process control instrumentation in the counties of Leicester, Stafford, Shropshire, Derby, the Birmingham area and Mid Wales.

Mr. Hollyman served an engineering apprenticeship with Kelvin Hughes and received sales office training before becoming assistant service manager, based at Barkingside, Essex.

He can be contacted at Smiths Industrial Division's area office:

184 Corporation Street,
Birmingham, 4.
Telephone: Central 8737.

Mr. E. E. Blake, who has been with Kodak for more than 50 years, has relinquished his appointment as a director of the company, but will continue to serve as a consultant on matters relating to Motion Picture Film business.

Mr. S. C. Smyth, F.C.A., who has been financial comptroller of Kodak Ltd. since 1952, relinquished this appointment on 31st December and will relinquish his appointment as a director on 31st March. Mr. Smyth has been in the service of the Kodak organisation, firstly in France and later in this country, since 1930.

To fill the vacancies arising on the board, **Mr. N. A. Brick** has been appointed a director and **Mr. W. F. Taylor** is to be appointed a director with effect from 1st April, 1961. Mr. Brick has recently been appointed deputy manager of Harrow factory, and Mr. Taylor, until recently deputy comptroller, became comptroller of the company, following the resignation of Mr. Smyth.

Following the Ekco-Pye merger it is announced that **Mr. N. A. Twemlow, M.B.E.,** director of Pye Ltd., has been appointed to the board of E. K. Cole Ltd. and **Mr. W. M. York,** commercial director of E. K. Cole Ltd., becomes a director of Pye Ltd.

Mr. Twemlow is a director of a number of the Pye Group of Companies. He has previously been connected with Ekco, with whom he spent a short time before joining Pye in 1934.

Mr. York joined Ekco in 1932. He is a director of a number of the companies which form the Ekco Group and a director of Radio Industry Exhibitions Ltd. He was elected vice-chairman of B.R.E.M.A. in April, 1960.

The English Electric Valve Co. Ltd. has appointed **Mr. M. Esterson** manager of the newly-formed high power klystron division. This division has been formed in view of the company's increasing activities in this field and co-ordinates work previously done in separate divisions.

Several other appointments have been made to strengthen the chain of management because of the steady expansion of most products and the following are appointed assistant divisional managers: **Mr. J. R. Bagnall,** small klystrons; **Mr. G. O. Chalk,** microwave research; **Dr. J. C. Firmin,** memory tubes; **Mr. M. A. Gates,** large valves; **Mr. E. D. Hendry,** photo-electric tubes; **Mr. R. E. Lake,** cold cathode tubes; **Dr. A. H. Pickering,** magnetrons, and **Mr. W. D. Rivers,** small valves.

Square D Ltd. announce the appointment of **Mr. G. K. Robinson** as their Newcastle branch manager.

Prior to his appointment Mr. Robinson was operating from the company's London Field Office as a field engineer.

FORTHCOMING EVENTS

March 21st. **Institution of Electrical Engineers.** Measurement and Control Section. Savoy Place, London, W.C.2, at 5-30 p.m. "Self-Adaptive Control Systems." J. H. Westcott, J. L. Douce, P. E. W. Grensted and P. H. Hammond.

March 22nd. **The British Institution of Radio Engineers.** Computer Group. London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, at 5-30 p.m. "The Future of High Speed Storage Systems."—Discussion.

March 22nd. **The British Institution of Radio Engineers.** West Midlands Section. Birmingham University, at 6-15 p.m. "A Pulse Time Multiplex System for Stereophonic Broadcasting." G. D. Browne.

March 23rd. **The British Institution of Radio Engineers.** South Midlands Section. Winter Gardens, Malvern, at 7-0 p.m. "Magnetic Film Storage." A. C. Moore.

March 23rd. **Society of Instrument Technology.** Chester Section. Lecture Theatre, Administration Building, The Associated Ethyl Co. Ltd., Oil Sites Road, Ellesmere Port, Wirral, at 7-0 p.m. "Electromagnetic Flowmeters." L. M. Bennett.

March 24th. **Society of Instrument Technology.** Cheltenham Section. Bell Vue Hotel, Cheltenham, at 7-30 p.m. "The Measurement of Vibration."

March 24th. **Society of Instrument Technology.** Scottish Section. Building Centre, Sauchiehall Street, Glasgow, at 7-15 p.m. Annual General Meeting followed by a Report from Prof. G. D. S. MacLellan on the Moscow Congress.

March 24th. **Society of Instrument Technology.** South Yorkshire Section. University, St. George's Square, Sheffield, 1, at 7-0 p.m. Annual Dinner.

March 27th. **The British Institution of Radio Engineers.** Medical Electronics Group. Post Graduate Medical School, University of London, Hammersmith, W.12, at 3-0 p.m. Symposium on "Electronic Instruments for Cardiac Surgery."

March 28th. **Society of Instrument Technology.** Control Section. Manson House, 26 Portland Place, London, W.1, at 5-0 p.m. "Automatic Optimisation". Dr. P. E. W. Grensted and O. L. R. Jacobs, at 7-0 p.m. "The Development of an Optimising Controller." P. F. Sutherby.

March 29th. **The British Institution of Radio Engineers.** London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, at 3-0 p.m. Symposium on "Electronic Instrumentation for Nuclear Power Stations."

March 29th. **Society of Instrument Technology.** South Wales Section. Welsh College of Advanced Technology, Cardiff, at 6-45 p.m. Annual General Meeting followed by "Feedback". R. S. Medlock.

April 3rd. **Society of Instrument Technology.** South Yorkshire Section. University. St. George's Square, Sheffield, 1, at 7-0 p.m. Annual General Meeting followed by Chairman's Address, "Feedback in Management Control". M. Thomas.

April 5th. **The British Institution of Radio Engineers.** Scottish Section. Department of Natural Philosophy, The University, Drummond Street, Edinburgh, at 7-0 p.m. Annual General Meeting.

April 6th. **The British Institution of Radio Engineers.** North Western Section. Reynolds Hall, College of Technology, Manchester, 1, at 7-0 p.m. "Plant Investigation and Control using Digital Techniques." K. J. McCarthy.

April 6th. **The British Institution of Radio Engineers.** Television Group. London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, at 5-30 p.m. Discussion on "Transistorised Television Receivers".

April 7th. **Society of Instrument Technology.** Fawley Section. Administration Building, Esso Refinery, Fawley, at 5-30 p.m. Annual General Meeting followed by Film Show.

April 10th. **Society of Instrument Technology.** Manchester Section. Nags Head, Jacksons Row, Manchester, at 6-45 p.m. "Industrial Application of T.V."

April 12th. **The British Institution of Radio Engineers.** Electro-Acoustics Group. The London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, at 5-30 p.m. "Vibration Analysis and Testing." D. E. Mullinger.

April 12th. **The British Institution of Radio Engineers.** North Eastern Section. Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6-0 p.m. Annual General Meeting of Section followed by "Colour Television". G. N. Patchett.

April 13th. **Society of Instrument Technology.** Liverpool Section. M.A.N.W.E.B. Industrial Development Centre, Liverpool, at 7-0 p.m. An Address by R. S. Medlock.

April 14th. **Society of Instrument Technology.** Midland Section. Lecture Hall, Byng Kendrick Suite, Gosta Green College of Technology, Aston Street, Birmingham, at 7-0 p.m. Annual General Meeting.

April 17th. **Society of Instrument Technology.** Bristol Section. University of Bristol, Department of Physics, The Royal Fort, Bristol, 8, at 7-30 p.m. Annual General Meeting followed by Film Show.

April 18th. **Society of Instrument Technology.** Tees-side Section. Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7-30 p.m. Joint Meeting with The Institute of Physics.

SOCIETY OF INSTRUMENT TECHNOLOGY

Grangemouth Section

THE first Annual Dinner of the Grangemouth Section was held in the Leapark Hotel, Grangemouth, on Friday, 14th October, 1960, and was attended by forty-five members and guests.

The chairman of the Section, Mr. H. Slack, after proposing the toast to the Queen, made the apologies for absence of Commander Pollard, secretary of the Society of Technology, and welcomed Mr. D. C. Nutting as a member of the Society's Council, also Mr. G. C. Baily, production manager of the Scottish Tar Distillers who proposed the toast to "The Society of Instrument Technology".

Mr. G. C. Baily pointed out that although the smaller industries did not use a great number of instruments they are well aware of the importance they play in production and he traced back, as far as 1938 to the present day, his experiences, saying that modern industry cannot grow without the new advances in technology and instrumentation. The reply to the toast was given by Mr. J. Dunsire (Grangemouth Section), who amused the company by relating some of his own interesting moments.

Mr. D. C. Nutting, in proposing a vote of thanks to the Section, stimulated the gathering when he mentioned the work of the Council's Educational Committee, who are making great efforts for higher recognition of the Society and explained some of the difficulties which had yet to be overcome. He told the audience of the rapid growth of instrumentation and how its prestige was spreading throughout many industries in the United Kingdom.

A most enjoyable meal and light entertainment made this, the first official social function to be held by the Grangemouth Section, a memorable and successful occasion.

On the 20th October the Grangemouth Section's vice-chairman, Mr. Worsely, welcomed Dr. D. G. Stevenson who spoke on "Analytical Instruments for Process Control". The speaker discussed optical devices suitable for use under plant conditions and the basic principles of the different instruments, determining their advantages and limitations, also indicating where a particular type of analyser should be used.

By the aid of sketches and slides, various models of analyser which were suitable for inclusion in the process control loops were explained in an interesting and detailed way.

Many searching questions were asked of Dr. Stevenson, who gave very informative and helpful answers.

The meeting closed with a vote of thanks proposed by Mr. S. Skilling.

Midlands Section

THE minutes of the last meeting were read, approved and signed, and the chairman gave some further news about the forthcoming conference which is to be held on Wednesday, 29th March, 1961. The secretary, Mr. Smith, welcomed recent members to the Midlands Section, and gave the figures showing members of the Midlands Section to comprise approximately 10% of total membership. The chairman then introduced the speaker for the evening, Mr. C. E. T. Cridland, M.I.E.E., to present his paper on "The Commonsense Approach to Instrument Manufacture".

In the ensuing paper, Mr. Cridland was both witty and instructive about the many ways in which common sense and a down-to-earth attitude could save money in a manufacturing industry. One of his basic comments was that the impossible could perhaps not be done in the immediate future, but it was amazing what could be done by a man "with a tiger behind him". As one instance of this, he quoted the fact that when he took over Aldis he investigated prices and was advised that a certain item could not be manufactured at under approximately £30. He immediately sold a batch at 18 guineas and made the predicted loss. However, he continued to sell at the same price and the efforts made by all concerned to reduce the loss resulted in an eventual considerable profit when the unit was sold at this price.

Mr. Cridland showed how, by methods which were obvious when stated, but were unfortunately frequently overlooked, money could be saved in practically any industry, and gave instances ranging from a buyers' exhibition, at which all the produce which he had bought from outside was displayed with their prices and representatives invited to come and offer lower prices if they could, to the omission of serial numbers from standard equipment, so that the cost of printing the numbers was eliminated and, in fact, provided a most entertaining lecture.

At the conclusion of the lecture, Mr. Cridland invited questions and comments and, after a most interesting question time, Mr. Bernard Sloan proposed a vote of thanks on behalf of the members and friends present.

The minutes of the last meeting were read, approved and signed and Mr. O'Dell then mentioned the forthcoming conference on the value of instruments to the small user. We aim to get 200 small manufacturers present and to have an exhibition of instruments in the foyer of the conference. He also mentioned that, under the constitution of the Society, committee members would be retiring at the end of the year and asked members to think about whom they would like to

represent them on the committee for the forthcoming season.

Mr. D. Smith welcomed new members; and the chairman then introduced the speaker for the evening, Professor J. E. Parton, B.Sc., Ph.D., M.I.E.S., A.M.I. Mech.E., to give his paper on "The Training of Instrument Engineers".

Professor Parton first of all stressed the need for engineers by showing that 60% of British visible exports are engineering products. He gave figures showing the power used per head in America, England, Europe and the rest of the world, showing that we were second only to the Americans in our use of power. He showed that an American worker has approximately 7 h.p. available, although an English worker normally has about 2 to 3 h.p. per person. Of the population of the country, in the working bracket, he said that 57 out of every thousand in Britain are engineers, the American figure is 136, and the Russian figure is now 280 people entering industry in every thousand are technically trained. He then emphasised the importance of technically trained people, inasmuch that they cost about £10,000 for industry to train and they are, therefore, a valuable asset.

Mr. Parton then proceeded to define the three grades of technician as the craftsman, the technician, and the fully-fledged engineer. The craftsman, he said, is someone who can repair instruments and generally maintain them, a technician is one who can maintain and look after an assemblage of instruments including diagnosing which instrument is faulty, whilst an engineer can design new systems, where required. All three grades have their place in industry and Professor Parton proceeded to enlarge on the training given to engineers at Nottingham University.

He gave comprehensive details of a syllabus which the prospective engineer must study and, in fact, followed his course from entering the University to emerging as an Honours B.Sc.

As time was running short, Professor Parton then concluded his lecture and threw the meeting open to a most lively and stimulating discussion, at which views were expressed from the floor on subjects ranging from training uneducated Malayans to instrument craftsman standard, to the various technical courses in the Midlands area which catered for personnel to transfer from an existing craft to instrument maintenance.

Mr. Pat Simpson then proposed a vote of thanks on behalf of all the members and friends present.

The minutes of the last meeting were read, approved and signed and the chairman then called on the secretary, Mr. Smith, who welcomed new, upgraded and transferred members to the Section. He announced a symposium on computers for electrical engineers, to be held on 28th March at the Birmingham University, and awarded the Section's annual prize to Mr. Bird. The chairman then mentioned the progress of the symposium, to be held by the Society, and introduced Captain A. M. A. Majendie, M.A., A.F.R.A.E.S., F.I.N., to present his paper on "Aspects of Instrument Development for the All-weather Operation of Aircraft".

Captain Majendie opened his paper by explaining that he was concerned with the operation of aircraft in all weathers when it was practicable to fly, although the pilot might not be able to land due to fog or cloud. Landing was a most important operation, as 40% of all aircraft accidents occurred during landing and approach. In fact, incidents averaged four per million landings. The control of this aspect of aircraft operation is extremely difficult, as it requires that the aircraft be positioned about all three axes, and its speed should also be controlled. He described how a landing should be performed and showed that if instruments were used at all there was a moment of criticality when the pilot had to change his attention from his instruments to the outside world. This transition moment was a source of great difficulty, and instrumentation was aimed at reducing this transition difficulty to a minimum.

He described various methods of presentation of instruments, and finished up by describing the Smiths paravisual director to give instrument information to the pilot by his extrafoveal vision. A film of this was shown. Having shown that the pilot was one of the weak links in the chain of landing, the speaker went on to consider the fully automatic landings, and stated that the aim of reliability for the equipment was better than one incident per million operations. At the moment they were aiming at one incident in ten million landings, and this was far in advance of the reliability of equipment at present produced, so that, at the moment, if an automatic equipment was used, the pilot would be concentrating on monitory landing of the aircraft and would require two assistants monitoring the performance of the automatic equipment, which was not a satisfactory state of affairs. The two presently proposed systems of automatic landing were described, these being the BLEU developed device using leader cables and a radio altimeter, and the American Bell equipment using radar and a ground base computer. A film was shown of the BLEU mechanism and it was shown that safe landings could be performed quite satisfactorily while the equipment was functioning correctly.

The devices fed information into an auto-pilot and Captain Majendie then proceeded to describe improvements in auto-pilots to increase reliability. A film was shown of the development and trials of a Triplex system, where all components on blind landing controls were supplied in triplicate, and if one channel failed the other two channels automatically overrode it, so that landing would continue without the pilot having to intervene or an incident developing.

A lively question period followed, during which Captain Majendie showed a thorough knowledge of the Triplex system, which extends from the input gyroscopes, right through the complete system to the actuators, and showed that even at the actuator stage, where mechanical problems might arise, three motors were used, and these were protected in three different ways so that a fault in one channel would either switch off that channel by a torque switch on the associated motor, or cause that channel to be overridden by the other two motors, each of which was strong enough to control the surfac unaided, or mechanically disconnect the sending motor by a mechanism similar to a shear pin. Mr. Don Lloyd then proposed a vote of thanks on behalf of the members and friends present.

South Wales Section

THE South Wales Section of the Society of Instrument Technology held the first meeting of the 1960/61 Session on the 28th September, 1960, in the Physics Lecture Theatre of the Welsh College of Advanced Technology, Dr. J. R. Bristow in the chair.

Opening the meeting, the chairman said that the speaker for the evening, Mr. S. W. J. Wallis, of B.P. Ltd., needed no introduction to members. He was a vice-president of the Society and had been very closely connected with instrumentation for many years. His talk on "Instrument Installation and Maintenance Costs" was an innovation for the Section and members would welcome the opportunity of hearing the views of Mr. Wallis on this subject.

In his opening remarks the lecturer said that the cost of instrumentation was a significant proportion of the cost of the plant, amounting to 5 – 12% of the total capital investment. This expenditure was justified by increased efficiency and stability and reduced maintenance and manpower requirements. From the financial aspect, it was often difficult to justify the increased use of expensive instrumentation. The cost of the necessary ancillary equipment often exceeded 50% of the basic cost and it was mentioned that at one particular plant the total cost was more than three times the basic instrument cost.

Mr. Wallis did not favour quoting actual prices, but preferred to express the cost of the necessary accessories and installation requirements as a percentage of the basic instrument cost, which was taken as 100%. Expressed in this way, the figures obtained for specific installations were surprisingly similar for both pneumatic and electric control systems.

The importance of efficient instrument maintenance was stressed and, though for the smaller firm this often presented problems, the large concern usually provided a fully integrated instrument repair shop. The many factors affecting the various industries and indeed the diverse nature of the instruments themselves made it difficult to generalise on maintenance costs. It was not easy, for example, to correlate the maintenance charges for a pressure gauge and a potentiometric recorder. However, from the results of a long-term investigation, maintenance index numbers had been obtained for various instruments and a basis established for comparison. Thus the simple pressure gauge would be represented by one unit and the flow recorder by twenty units. By means of this system the maintenance costs of individual types of instruments could be assessed and it was found that the normal charge for maintenance averaged 10 – 15% of the basic instrument cost.

Finally, Mr. Wallis quoted the average instrument maintenance costs over a period of three years for a large plant and

showed that the total maintenance charge in this case was 10½% of the capital investment. The instrumentation was justified by increased efficiency and yield and it was significant to note that a 1% increase in yield would pay off the instrument costs in a relatively short time.

A lively discussion followed, many interesting points being raised, and it was evident that members from many very different industries were in agreement with the speaker on the more controversial points.

In proposing a vote of thanks to Mr. Wallis, Mr. W. Somerville Vernon expressed the appreciation of the meeting for a stimulating lecture and for presenting in such an interesting manner a subject which could well develop into a mass of statistics. The Section was also very happy and privileged to have as speaker for the first meeting of the current Session a vice-president of the Society.

Tees-side Section

In the presence of twenty-five members and nine visitors, Mr. B. W. Ramsay, the Section chairman, opened the 95th ordinary meeting by calling upon the secretary to make a special announcement. This was that Mr. Edge had asked the committee to accept his resignation as chairman due to ill health and that the committee had reluctantly agreed to do so. The secretary went on to explain to the meeting that Mr. B. W. Ramsay, as vice-chairman, had been elevated to the chair. The members present were asked to show their approval of this change and did so unanimously.

Mr. Ramsay then introduced the speaker for the evening, Mr. O. S. Denham, of Babcock and Wilcox, who presented his paper "Steam Raising Plants and Their Control Problems". Mr. Denham began by stating that statutory regulations demanded the fitting of at least three instruments to every boiler, i.e., a safety valve, a water level gauge and a pressure gauge; and in some of the smaller boilers these are all that are fitted. However, since the era of cheap fuel has now gone, it has become essential to run boilers more efficiently, and a measure of this can be obtained in terms of either the excess air remaining after combustion or of the ratio of steam flow to air flow.

Mr. Denham went on to describe a number of different types of boiler, including grate firing, pulverised fuel firing and oil firing. The lecturer also covered all sizes of boiler, from a small type installed in 1896 and which is still working, to a very modern unit producing 4½ million pounds of steam per hour at about 2,300 p.s.i. The question of the automatic electronic computer control of boilers was also mentioned.

Mr. V. H. Brown opened the discussion and some of the points which emerged were as follows:

In what way would a computer controlled boiler improve efficiency?—A marginal improvement in efficiency of ½% represents quite a large saving in fuel costs and such an improvement should be possible if decreases in efficiency are noted immediately.

What advantages have cyclone-fired boilers over other types?—They are safer in operation and there is a very low grit emission. In fact it would be possible to use them without a precipitator if this was permissible by law.

What percentage of the capital cost of a boiler is due to instrumentation?—About 2% on a large boiler and about 7% on a small boiler.

Mr. Ludbrook proposed the vote of thanks which was warmly supported.

In the presence of twenty-one members and five visitors, Mr. B. W. Ramsay, the Section chairman, opened the 96th Ordinary Meeting and introduced the first speaker for the evening, Mr. T. B. Kent, of I.C.I., Billingham.

Mr. Kent commenced his lecture on "Chromatography" by stating that the apparatus for this technique was not only cheaper than that used in auto-distillation columns, infra-red spectrometers and mass spectrometers, but also gave the result far quicker and in a far easier form for interpretation. This was followed by a description of the various key components of a chromatographic unit: the injector, the column and the detector; and also how the variations in the design parameters such as carrier gas, column packing and liquid phase can change both resolution, sensitivity and speed of response. Packed columns are usually between 3 and 30 ft in length and need to be thermostated to within ±1°C, whereas capillary columns are usually of the order of 100 ft in length.

The three most common detectors, i.e., thermal-conductivity cell, theargon ionisation detector and the flame ionisation detector were also described. It was mentioned that with special apparatus elution times as short as 5 sec can be achieved. Mr. A. McDonald opened the very lively discussion.

Before introducing the second speaker, the chairman announced that Mr. V. H. Brown had been co-opted to the Section committee as vice-chairman, and that Mr. T. R. Peacock had also been co-opted. The proposed changes in the Society's name and in its grades of membership were briefly described.

The second speaker for the evening, Mr. M. S. Beck, of I.C.I., Billingham, was then introduced. Mr. Beck spoke on "Practical Aspects of Plant Measurement" with particular reference to the measurement of level in silos, the determination of pH, and the flow of dirty liquids.

A wide variety of different principles were suggested for use in level alarms, for example, the actuation of a pressure switch, the change in capacity of a probe, the stalling of a rotating paddle, or the interruption of a radioactive beam. If, however, a continuous measurement of level is required the problem is more difficult, although two possibilities are (i) to have the silo supported in such a way that its weight can be continuously monitored, or (ii) the capacitance method may be used if the water content of the material is fairly constant. A novel device was also described for use when the material is above ambient temperature. In this, a large number of thermocouples are supported at different levels and the differences between adjacent couples is measured. The level obviously lies between the points showing the greatest difference.

Mr. Beck described how, in the measurement of pH, glass electrodes have replaced the older type of metal electrodes. He then went on to stress the importance of perfect insulation of these electrodes, since even a leakage path as high as 100 MΩ would introduce considerable errors.

For measurements of dirty liquids, Mr. Beck described the electro-magnetic flowmeter, the pneumatic transmitting rotameter, the Niveau and the Venturi. Their relative advantages and disadvantages were also described.

The discussion was opened by Mr. N. Settle, and during this the lecturer described a further method of discontinuous level alarm, that of the side tube anemometer.

A vote of thanks to both speakers was proposed by Mr. T. R. Peacock and was warmly supported.

Continued from page 350

Radiation Shielding Windows

The latest booklet from Chance Pilkington gives details of window design, glass-densities and the method of sealing against alpha contamination for radiation shielding windows.

Circle **80** *for further details.*

Silicon Cartridge Rectifiers

The International Rectifier Co. have issued two new leaflets—the first describes their range of high voltage, high temperature silicon cartridge rectifiers operable up to +150°C. At 25°C and 300 mA the maximum forward voltage drop is 4·5 volts. At 75°C (at rated p.i.v. of −1,500 volts d.c.) reverse leakage is 100 μA.

The second leaflet describes their range of miniature, high altitude, silicon cartridge rectifiers which have a ceramic package designed to increase surface creepage distance and thus lower the probability of flash-over or corona during high altitude operation. The temperature range of operation is −55 to +150°C.

Circle **81** *for further details.*

Moulded Rocker Contact Switches

A leaflet from A. F. Bulgin & Co. gives details in chart form of the action of the switches, the number of terminals, panel data, and maximum ampere ratings.

Circle **82** *for further details.*

Ovens and Incubators

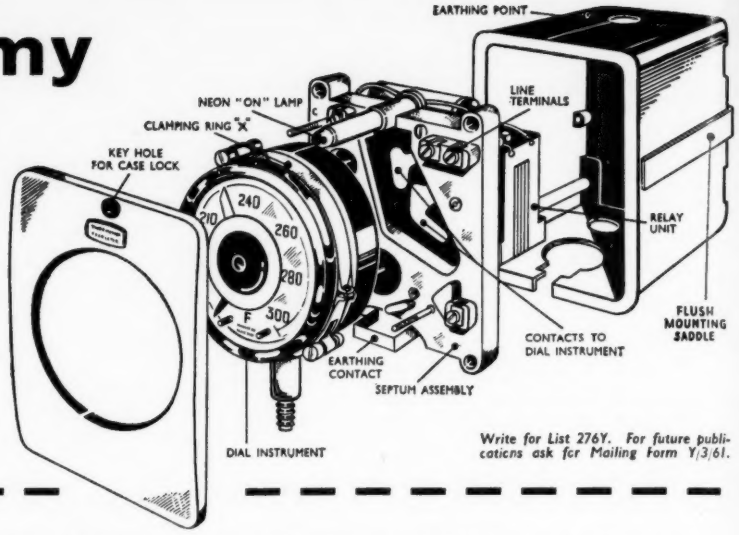
Baird & Tatlock's intermediate oven has a stainless steel chamber 22 × 19½ × 18½ in. with three removable shelves. The maximum temperature variation is 4·5°C at 100°C and 5°C at 200°C while the maximum temperature fluctuation is 1·0°C.

The B.T.L. anhydric incubators have a temperature fluctuation not exceeding 2°C over the range 25 to 110°C. The chamber, 18 × 16 × 16 in., is fitted with three removable perforated aluminium shelves.

Circle **83** *for further details.*

Circle **168** for further information

For economy IN CONTROL in every industry...

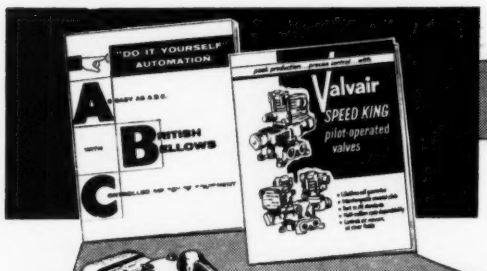


Write for List 276Y. For future publications ask for Mailing Form Y/3/61.

There is scarcely an industry which does not employ the Cambridge Thermometer Regulator (or Pressure or Gas Regulator) for temperature or pressure control vital to the quality of the product.
It will be found in such diverse operations as air conditioning, chocolate manufacture, chromium plating, photographic processing, degreasing, hop kilns, laundering, printing, plastic moulding, refrigeration plants, transformer cooling. The illustration shows the simple and sturdy construction of the instrument, which consists of a Cambridge 4-inch dial thermometer with contacts (set with a key) and an associated relay unit.
This controller is completely self-contained and measures only 7½ ins. x 5½ ins. x 5½ ins. Yet it employs a 20 amp (sometimes 30 amp) relay within the case. Installation is simple and involves the connections of only 5 wires at most to the mains supply and to the source of heat. A wide variety of bulbs to suit various applications is available. The modest cost of the Cambridge Thermometer Regulator brings *"control"* to the smallest manufacturer.

Cambridge **THERMOMETER REGULATORS** (AND GAS AND PRESSURE REGULATORS)

CAMBRIDGE INSTRUMENT COMPANY LIMITED 13 GROSVENOR PLACE LONDON SW1



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You can now choose air power equipment from the combined ranges of Bellows and Valvair. Most comprehensive choice there is! Fast, flexible, safe . . . Bellows-Valvair Equipment is production-proved on a multitude of jobs.
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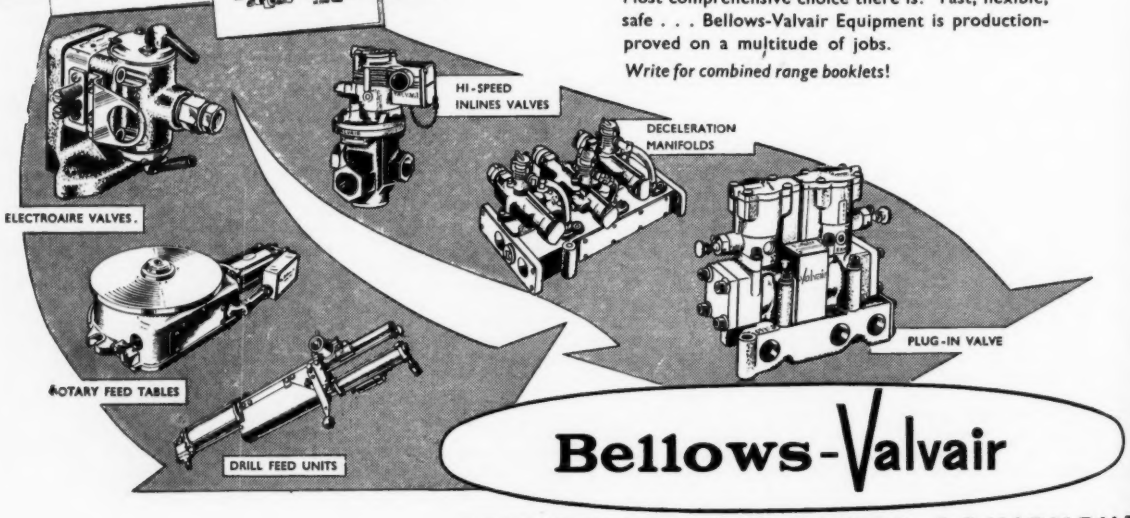


Bellows-Valvair

CONTROLLED AIR POWER EQUIPMENT

BELLOWS-VALVAIR LIMITED, 1206 STRATFORD ROAD, HALL GREEN, BIRMINGHAM, 28. Tel.: Springfield 6059

Circle **169** for further information

Stabilised D.C. Power Supply Units

The Series PST power supplies are described in a leaflet from Claude Lyons Ltd. The supply has no valves and ripple is of the order of 1%. The output voltage is adjustable over a range of ±15% about the nominal value.

Circle **84** *for further details.*

Burette and Stopcock

Loughborough Glass Co. now have available a special version of their p.t.f.e. glass stopcock which makes possible a burette which can handle all solutions including caustics without seizure of the stopcock. It is described briefly in their latest leaflet.

Circle **85** *for further details.*

Centre Squares

Catalogues from Moore & Wright (Sheffield) Ltd. describe briefly their centre squares, made in two sizes for work up to 1½ in. diameter and 3 in. diameter respectively.

Circle **86** *for further details.*

E.M.I. Short Form Catalogue

The Short Form Catalogue recently published by E.M.I. Electronics Ltd.'s Instrument Division covers all the Division's products—from colour television cameras to electronic photographic equipment, analogue computers to nuclear health monitors.

Details are given of E.M.I.'s wide range of industrial stroboscopes, oscilloscopes, instrumentation tape decks and multi-track heads.

E.M.I.'s black-and-white closed circuit television equipment is also described, and many different remote-control units and other accessories are shown.

Circle **87** *for further details.*

D.C. Motors and Tachogenerator

The latest leaflets from Vactric (Control Equipment) Ltd. describes their size 07 permanent magnet d.c. motor, sizes 11 and 15 split-field d.c. motors, and size 11 low inertia d.c. tachogenerator.

Circle **88** *for further details.*

Pressure Switches

Londex have brought out a new 16-page catalogue, reference 119/J, covering their range of pressure switches. Among the new pressure switches listed is the Type PS/A, suitable for operating on extremely low pressures.

Circle **89** *for further details.*

Photographic Automation

Telford Products Ltd. are sole importers and distributors for a 33 mm camera which can be used as an ordinary camera, or to take pictures at rates varying from 4 per second to 1 in 24 hours. Its applications include product or process recording, work study, oscilloscope and microscope photography, security and document copying. This camera and accessories are described in their leatest leaflet.

Circle **90** *for further details.*

Programmed Industrial Control System

Automation Engineering Systems' PIC programmed industrial control apparatus is a multi-purpose instrumentation system which is suitable for operating a variety of machines or processes. The instrument is a 2-channel sequence controller.

PIC instruments are constructed from standardised sub-units according to the control requirements of the machine or process. A questionnaire and leaflet describing the system are available from Customer Engineering Service of Automation Engineering Systems Ltd.

Circle **91** *for further details.*

Flow Measurement

George Kent Ltd. have produced a 52-page book on the "History of Flow Measurement by Pressure-Difference Devices". This book is a reprint of a series of articles which originally appeared in *Instrument Engineer* and is available from the company, price 10s. 0d.

Circle **92** *for further details.*

Electrical Contacts

Johnson Matthey have produced a 30-page booklet covering the subject of electrical contacts. Contact materials and design are considered and graphs given of head diameter and contact pressure. The range of forms in which JMC contact materials are manufactured are listed, together with the properties and availability of the various materials.

Circle **93** *for further details.*

Automatic Fraction Collector

Locarte's latest catalogue describes their automatic fraction collectors which have increased capacity and new turn-table setting over device. Various models are available incorporating drop counting, or time delay or a combination of the two.

Circle **94** *for further details.*

Industrial uses of Platinum Metals

This is the title of a publication available from Engelhard Industries. The applications listed include: glass fibre, glass container and optical glass production; thermocouples, resistance thermometers and electric furnace windings; electrical contacts; cathodic protection of ships and harbour installations; catalysts; high temperature brazing alloys and electroplating.

Circle **95** *for further details.*

Tape Reader

The Model 92 Creed tape reader is an inexpensive medium-speed input device for use in a variety of punched tape controlled data processing and automation systems. It is designed to operate at speeds up to 20 characters per second and it can be supplied for reading 5, 6, 7 or 8 track paper tape and delivers either a single or double current output on a multi-wire parallel basis.

It is described in Creed Publication 135-001-1E.

Circle **96** *for further details.*

Noise Measurement

Two publications on this subject have just been brought out by the General Radio Corp. of America, they are available in this country through Claude Lyons Ltd. The first publication, "Handbook of Noise Measurement", by A. P. G. Peterson and E. E. Gross, is a comprehensive 132-page book covering the theory and practice of sound measurement, using General Radio's instruments.

The second publication is a 20-page booklet "Instruments for the Measurement of Sound, Noise, and Vibration" which gives specifications of the General Radio instruments available.

Circle **97** *for further details.*

Foxboro-Yoxall

To mark their 25th anniversary Foxboro-Yoxall have brought out a new publication describing the activities of the company. Photographs and a brief description are given of the factories and departments within the company.

Circle **98** *for further details.*

This is United Steel

This is the title of a well-produced illustrated book which gives a general review of The United Steel Co. Ltd.

A brief account is given of the company's activities in ore mining, coal carbonisation, iron making, iron founding, steel making and shaping and in the manufacture of a wide range of products.

An outline is given of the company's research departments, personnel and works' services, and the commercial and accounting organisation.

Circle **99** *for further details.*

Level Controllers

Elcontrol's conductivity type level controllers are described in the new data sheet LR. These controllers are suitable both for conductive liquids and for free-flowing solids having an adequate moisture content.

Additions to the range which are described include the S5 certified safe control unit, and a series of probe fittings.

Circle **100** *for further details.*

Kodak School

Since 1943 Kodak have been running a school for Industrial and Engineering Radiography. Students range from beginners to radiologists of considerable experience. Details of the facilities offered by the Kodak School are given in the booklet available from the company.

Circle **101** *for further details.*

Pye Products

Pye have produced a guide to the products manufactured by their group of companies.

The guide lists the companies within the group, together with their addresses and telephone numbers, and the equipment manufactured by each company. There is a short index of products.

Circle **102** *for further details.*

Chemicals for Radiography and Medical Photography

Kodak's latest leaflet gives brief details of their "Cubitainer" chemically resistant plastic container in a cardboard box, for storing liquid chemicals.

Among the chemicals available from Kodak in these free containers are developers, replenishers, X-ray and rapid liquid fixers, and liquid hardener.

Circle **103** *for further details.*

Circle 170 for further information

Intrinsically safe

A.C. TACHOGENERATOR

The L.S.E. permanent magnet a.c. Tachogenerator carries the Factory Inspectorate certification (No. IS.3062) for use in hydrogen atmospheres (including pentane, petroleum, butane, acetone, etc.).

This is a robust instrument designed for use under industrial conditions. Suitable specially calibrated indicators can be supplied.

Leading data:

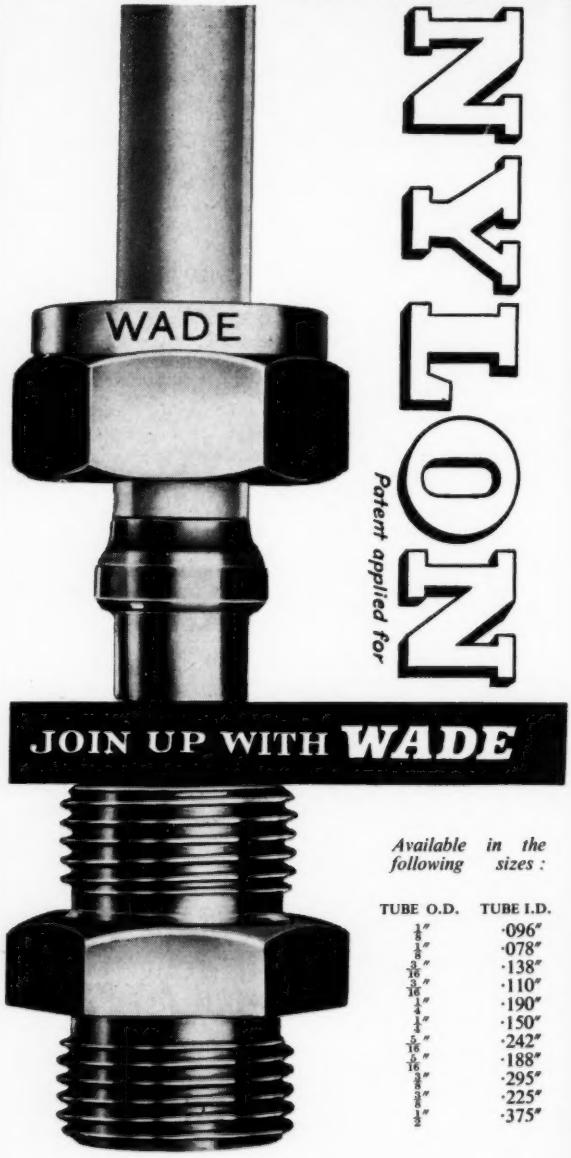
Open circuit terminal voltage	31 V ±1% at 1,000 r.p.m.
Winding	Three-phase, star-connected
Terminal resistance ...	9,500 ohms ±1%
Friction torque	0·5 oz.-in.
Moment of inertia of rotor	1·0 oz.-in.^{2}
Maximum rotor speed ...	4,000 r.p.m.

For fuller details of this and other L.S.E. instruments, apply to:

LAURENCE, SCOTT & ELECTROMOTORS LTD.

Instrument Department, Openshaw, MANCHESTER

Circle 171 for further information

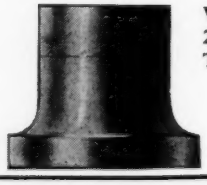


Available in the following sizes:

TUBE O.D.	TUBE I.D.
1/8"	·096"
1/8"	·078"
3/16"	·138"
3/16"	·110"
1/4"	·190"
1/4"	·150"
5/16"	·242"
5/16"	·188"
3/8"	·295"
3/8"	·225"
1/2"	·375"

For users of Nylon Tubing, Wade Couplings have designed this Brass Ferrule, which gives a wonderful clamping action, with no possibility of damaging the tube. Users of Copper and Nylon tubing have only to keep the "N" Ferrule as an extra, because the Wade Standard Medium Pressure fittings for copper tubing are designed to take this Ferrule.

WADE



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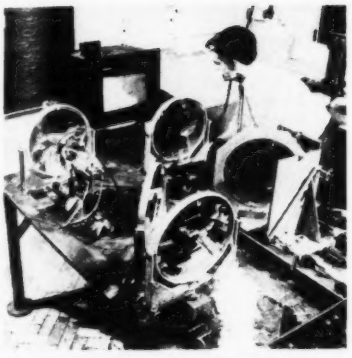
INSTRUMENT APPLICATIONS



Arrangement of the Michelson interferometer method of spectroscopy studies in the far infra-red being pioneered at the National Physical Laboratory. Honeywell recorder at rear.

Spectroscopy in the Far Infra-red

ELECTRONIC strip chart recorders with digitising units fed from Golay cells for detecting light radiation are now being used at the National Physical Laboratory, Teddington, in connection with pioneer experiments in far infra-red spectroscopy.

Many problems related to the properties of molecules and the nature of liquids and solids may be studied by passing light through the substances and measuring the wavelengths at which absorption takes place. But in the far infra-red this is experimentally difficult using conventional prism or grating instruments owing to the low energy output of available sources.

The N.P.L. have developed a system of far infra-red spectroscopy which does not use these conventional techniques. The system is based upon the Michelson interferometer and is designed to make more efficient use of the obtainable energy.

Using a Golay cell detector, the resultant intensity of two interfering beams is measured as a function of the path difference between them. The output from the Golay cell is recorded as a complex waveform which is uniquely related to the spectrum of the substance by its Fourier transform. Honeywell recorders are fitted with Giannini-Elliot digitisers which give punched paper tape results.

These are then fed into a computer which takes the transform and plots the spectrum.

The group at N.P.L., working under Dr. H. A. Gebbie, is believed to be in the forefront of experimental developments along these lines. Sample gases so far investigated include sulphur dioxide, ozone and hydrogen cyanide. Work is also in progress on other gases, in liquid and in the solid state, on semiconducting materials and superconductors.

Circle **104** *for further details.*

Magnetic Tape for Satellite Telemetry

CIRCLING the earth 14 times daily, the Courier satellite stores information on a magnetic tape until commanded to transmit. When in range of a ground station at either Puerto Rico or Fort Monmouth, N.J., Courier can receive 340,000 words in a five-minute period. Five tape recorders in the satellite store this information which is later relayed to the next station.

The tape units—each nolarger than a transistor radio—were developed in America by Consolidated Electrodynamics Corporation. Despite the unique achievement of combining the functions of record, reproduce and erase in a package weighing only 5½ pounds, primary consideration in design of the tape unit was reliability. The recorder and magnetic tape were expected to operate in extreme environmental conditions of altitude, temperature, humidity, vibration and shock—such as withstanding 30 *g* acceleration and vibration to 14 *g* at 2,000 c/s.

As the satellite is intended to orbit for at least a year, the tape in the recorders had to be designed with a relative wear factor five times greater than that of standard tapes. The requirement was for a tape that would stand up under extreme conditions of operating speed, temperature and head-to-tape pressure for a minimum of 10,000 passes across the recording heads.

The tape selected by CEC engineers is a heavy duty instrumentation tape produced by Minnesota Mining & Manufacturing Co.—SCOTCH Brand No. 199, with a 0·45 mil oxide coating on a 1 mil polyester backing.

Binder materials which Minesota Mining and Manufacturing Co.'s magnetic products laboratory developed specifically to meet the highly critical demands of video recording are used in the new tape to achieve a tougher, more durable tape surface. This is the first time such a binder has been used in any magnetic tape other than video tape.

The binder system minimises rub-off and head fouling. It has 1,000 times greater conductivity than conventional tape, thereby reducing static charge build-up which causes tape to momentarily "stick" to equipment. Field tests of the new tape have proved it wears a minimum of five times longer than conventional instrumentation tapes, yet maintains good resolution and freedom from dropouts.

Heavy duty tapes have been exposed to temperatures ranging from −40 to +250°F without showing binder deterioration.

Tape in the five Courier recorders—775 ft lengths of the quarter-inch No. 199—moves past the recording heads at 30 inches per second. The five tape units function in sequence. Four are designed to store teletype digital communications data, the fifth to test system capability with analogue or voice transformation. Each has capacity for recording five minutes on one channel, after which the tape reverses and reproduces on the return pass upon command from the ground.

Circle **105** *for further details.*

Examination of Placental Function by Ner Method

WHETHER to induce labour or to perform Caesarean section, will be an easier decision for obstetricians from now on if trials of an electronic blood flow recording method being carried out at Rochford General Hospital (Essex) are confirmed as reliable.

Hitherto, clinical methods have been used to judge the uterine blood flow and oxygen transfer from the maternal to the foetal circulations. It has long been hoped that some form of special test would be developed because the examination of symptoms clinically, usually needs to be supplemented. The trials of the new technique are being carried out under senior staffs of the Department of Obstetrics at the hospital.

Transfer of Sodium 24

The oxygen transfer not being accurately measureable in a patient, the technique consists of injecting sodium 24—sterile isotonic saline—intravenously and measuring the rate of transfer from the mother to the foetus which takes place through the placenta. The rate is counted on an Ekco scintillation counter containing a thallium-activated sodium iodide crystal.

Results of the count are automatically recorded on a Honeywell electronic strip chart recorder whose chart is moving at some four inches an hour. Recording normally proceeds for about an hour. A rapid cycling of the curve indicates good transfer but a steady or falling trace implies no transfer and indicates foetal death or the need for induced labour or surgery.

Trials of this technique have been going on since mid-summer 1960 and about 50 patients have been examined. It is stressed that clinical methods must remain the prime means of reaching a decision, but the current trials are expected to show that this technique is so completely reliable that after a doctor has given the initial injection of sodium 24, the examination may be carried out by a qualified technician.

The technique is a development of that first used by Dr. G. Trevor Johnson, Dr. F. T. Farmer and Mr. C. G. Clayton of King's College University of Durham and the Princess Mary Maternity Hospital, Newcastle-upon-Tyne.

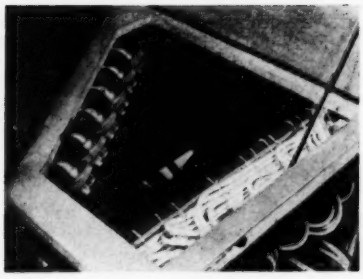
Circle **106** *for further details.*

Computer Aids Divers

AN IBM 650 computer recently produced in 3½ hours, 250,000 calculations to arrive at a 400-table chart of the mixture of oxygen and other gases to be breathed by a diver at depths down to 1,312 feet. A human mathematician would have needed two years for this work, whose accuracy was proved when its originator, Swiss mathematician Hannes Keller, descended 510 feet into Lake Maggiore and surfaced thirty-four minutes later without getting the "bends".

All previously accepted decompression tables specify a five to seven hour ascent from this depth to avoid "bends", the fatal expansion of nitrogen in the bloodstream.

Circle **107** *for further details.*



Conflex conduit system

Conduit System in Television Installations

THE latest control desk installed in the teleciné control room of the British Broadcasting Corporation Television Centre at Wood Lane, London, incorporates the CONFLEX—the electrical conduit system manufactured by Superflexit Ltd. of Slough.

The use of CONFLEX on an installation of this complexity is a new approach providing many advantages, particularly when terminated to plugs and sockets. It does away with complicated switching, eliminating some inherent troubles which are associated with circuit changing of this nature.

This control desk enables any of the 18 teleciné outputs to be routed to any duplexer, the function of which is to enable two teleciné machines to be sequentially switched to the output line so as to provide continuous presentation of film material. Eighteen duplexers are incorporated, each having two inputs.

Special attention was given to the lay of the conductors which included coaxials, quads, screened and unscreened conductors and, in keeping with all Superflexit conduit systems, individual conductors were used throughout. These are recommended in preference to conventional cables particularly as their use enables any type and formation of conductor to be utilised. Further, when subjected to severe flexing, far greater service life is provided. Each wired conduit assembly carries vision, sound, "talk-back", cueing and control circuits so that every precaution was necessary to avoid cross talk and interference between circuits.

Only two designs of conduit assemblies were used on the whole of the installation, so that interchangeability could be maintained. This is another important feature which enables a complete conduit assembly to be removed from the desk and replaced in a matter of minutes.

All the panel mounting connectors on the face of the control panel can be very easily removed and withdrawn completely as they are part of the conduit assemblies.

The use of the CONFLEX conduit system, apart from showing considerable time saving in installation and servicing, enabled this complex desk to be produced at less cost than could have been achieved by using more conventional methods such as automatic switching.

Circle **108** *for further details.*

Infra-red Analyser for Ford Motor Co.

FOR the detection of carbon monoxide leakage inside the cold room at Ford Motor Company's Dagenham plant, a Model 200 Lira infra-red analyser has been supplied by Mine Safety Appliances Co. Ltd., of Glasgow.

Engines on test in the cold room can be brought down to temperatures as low as −100°F, thus stimulating the most difficult operating conditions likely to be encountered. When the engines have been cooled to the required temperature it is necessary for engineers to enter the chamber and run the engines on test for periods of up to 30 min. Should there be a leak from the exhaust manifolds, a harmful concentration of CO could accumulate rapidly.

The Model 200 Lira has been set up outside the cold room, sampling from a point at the centre of the room. The instrument's range extends to 1,000 parts per million and it can be pre-set to raise a visual and audible alarm at any concentration within that range. The accuracy of indication is ±1% of full scale.

The alarm level used at the test plant is 400 p.p.m., which is tolerable for human exposure for periods of up to 30 min. Should a concentration of gas at any time exceed 400 p.p.m., the alarm is automatically activated.

Circle **109** *for further details.*

FORTHCOMING EXHIBITIONS

March 21st–25th. **10th Electrical Engineers Exhibition.** Earls Court, London.

March 27th–31st–April 3rd. **Symposium on Temperature—Its Measurement and Control in Science and Industry.** Veteran's Memorial Hall and Deshler-Hilton, Columbus, Ohio.

April 4th. **13th Annual Symposium on Electronic Process Instrumentation.** Hotel Essex, Newark, New Jersey.

April 5th–7th. **Symposium on Electrical Contacts.** Institute of Physics and The Physical Society, Brunel College of Technology, London.

April 17th—19th. **7th National ISA Symposium on Instrumental Methods of Analysis.** Shamrock Hotel, Houston, Texas.

April 17th–20th. **Annual Conference of the Ergonomics Research Society.** Bristol.

April 20th–May 4th. **Engineering, Marine, Welding and Nuclear Energy Exhibition.** Olympia, London.

April 30th–May 4th. **7th National ISA Aero - Space Instrumentation Symposium.** Adolphus Hotel, Dallas, Texas.

May 8th–10th. **4th National ISA Power Instrumentation Symposium.** LaSalle Hotel, Chicago, Illinois.

May 9th–17th. **International Exhibition of Measurement, Control, Regulation and Automation (Mesucora) and 58th Exhibition of French Physical Society.** C.N.I.T., Paris.

May 10th–12th. **Pulp and Paper Instrumentation Symposium.** Northland Hotel, Green Bay, Wisconsin.

May 15th–18th. **12th Annual Symposium on Spectroscopy.** Hilton Hotel, Chicago, Illinois.

May 15th–19th. **3rd International Automatic Vending Machine Exhibition.** Olympia, London.

May 15th–20th. **3rd International Hospital Equipment and Medical Services Exhibition.** Olympia, London.

May 30th–June 2nd. **Radio and Electronic Component Show.** Olympia, London.

May 22nd–24th. **10th National Telemetering Conference.** Hotel Morrison, Chicago, Illinois.

June 6th–8th. **ISA Instrument Automation Summer Conference and Exhibition.** Queen Elizabeth Hall, Toronto, Ontario, Canada.

June 12th–17th. **I.E.E. Conference on Components and Materials used in Electronic Engineering.** Central Hall, Westminster.

June 13th–16th–3rd. **Biennial ISA International Gas Chromatography Symposium.** Michigan State University, East Lansing, Michigan.

June 21st–July 1st. **International Plastics Exhibition and Convention.** London.

June 28th–30th—July 2nd. **Joint Automatic Control Conference.** Colorado University, Boulder, Colorado.

July 9th–14th. **4th International Conference On Bio-Medical Electronics and 14th Conference on Electronic Techniques in Medicine and Biology.** Waldorf Astoria Hotel, New York City.

Sept. 4th–9th. **Third International Sessions of the International Association for Analogue Computation.** Belgrade.

Sept. 5th–15th. **International Packaging Exhibition.** Olympia, London.

Sept. 6th–8th. **Joint Nuclear Instrumentation Symposium.** North Carolina State College, Raleigh, N. Carolina.

Sept. 11th–15th. **ISA Instrument Automation Fall Conference and Exhibit and ISA's 16th Annual Meeting.** Sports Arena, Los Angeles, California.

Oct. 2nd–11th. **49th Business Efficiency Exhibition.** Olympia, London.

Oct. 3rd–12th. **2nd Electronic Computer Exhibition.** Olympia, London.

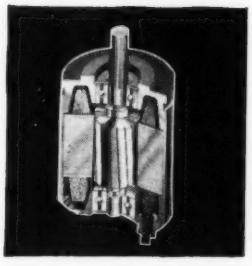
Oct. 4th–6th. **Business Computer Symposium.** Olympia, London.

Oct. 21st–29th. **7th International Fair, "Modern Electronics".** Ljubljana, Yugoslavia.

Nov. 13th–18th. **2nd Engineering Materials and Design Exhibition.** Earls Court, London.

Nov. 13th–18th. **9th Factory Equipment Exhibition.** Earls Court, London.

Circle **172** for further information



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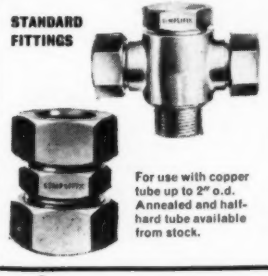

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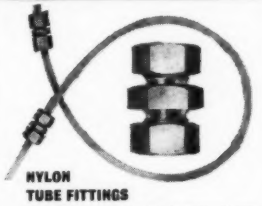

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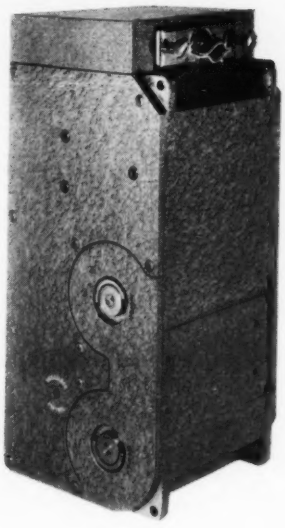

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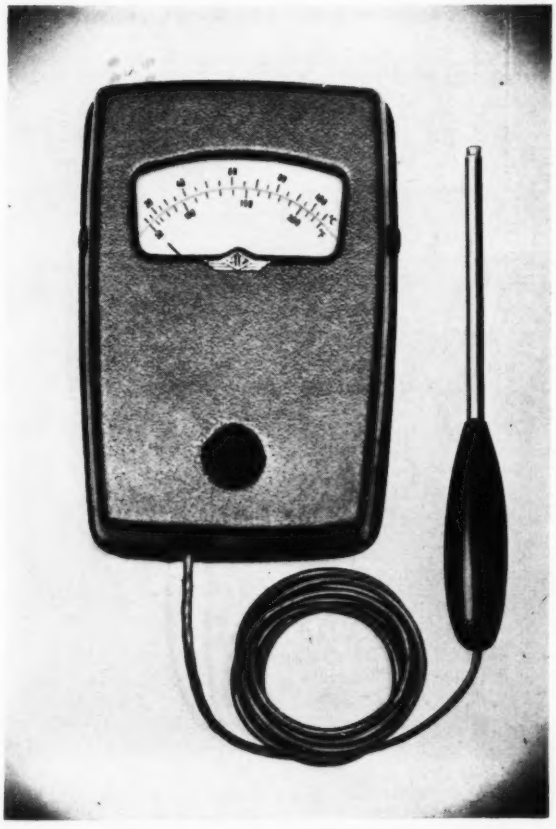

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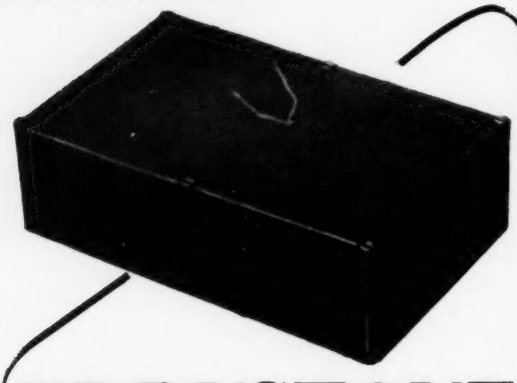

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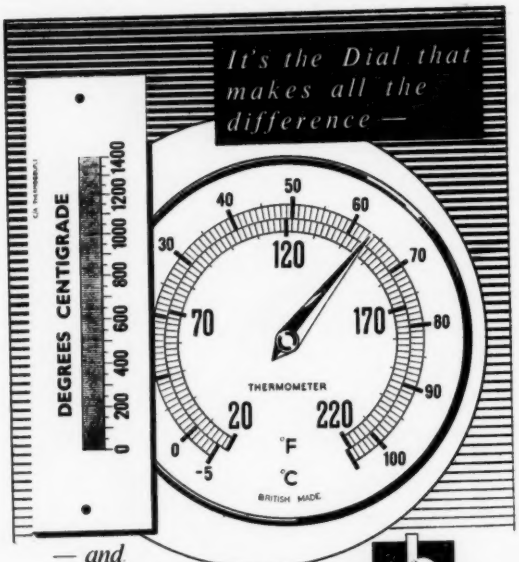

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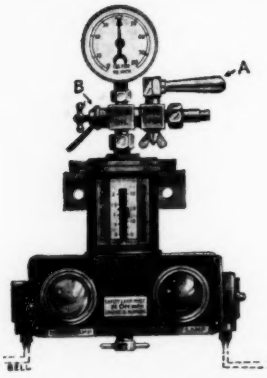

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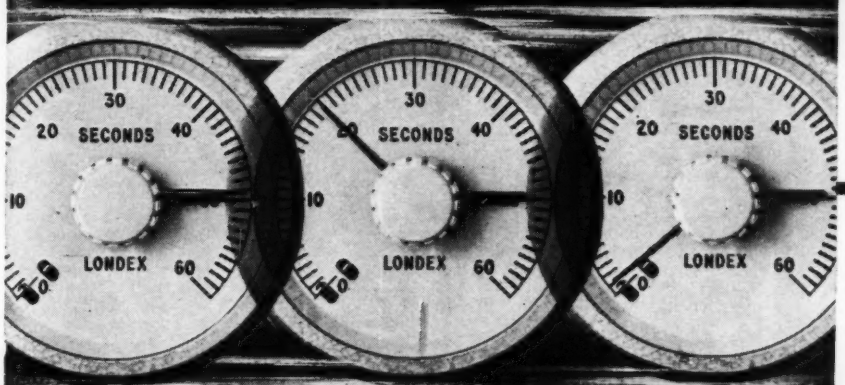

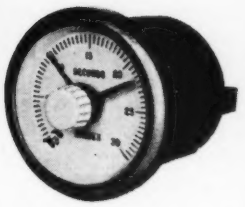

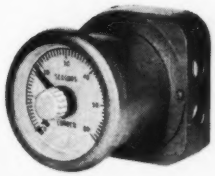

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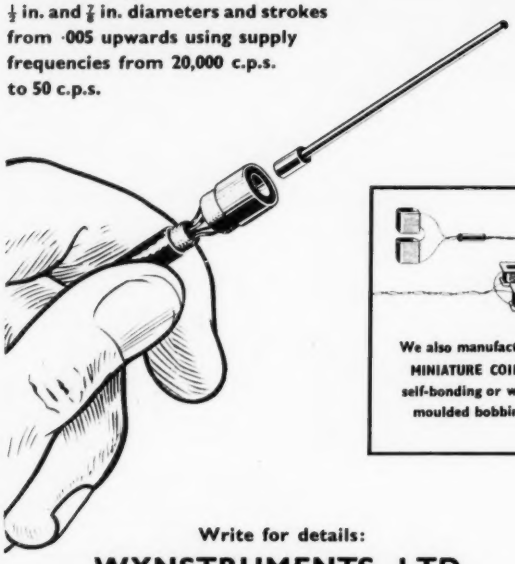

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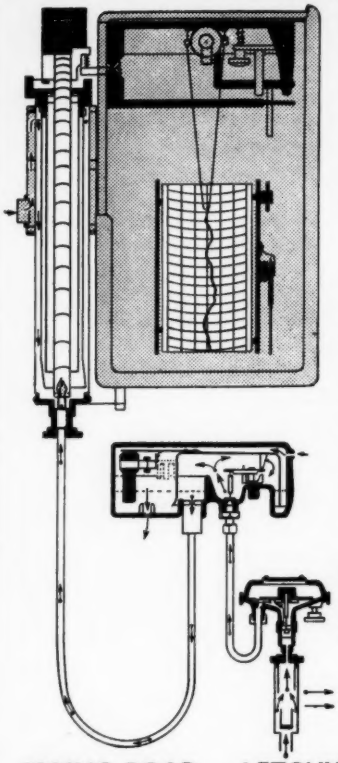

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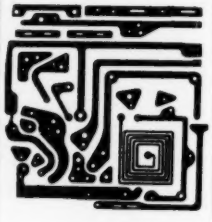

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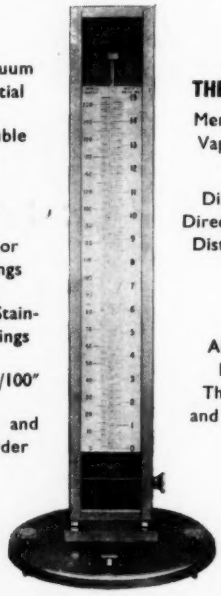

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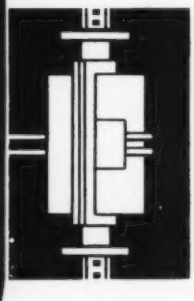

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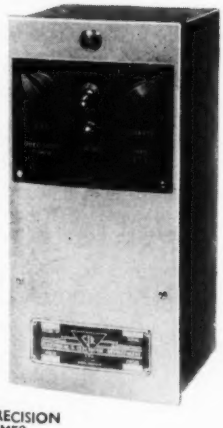

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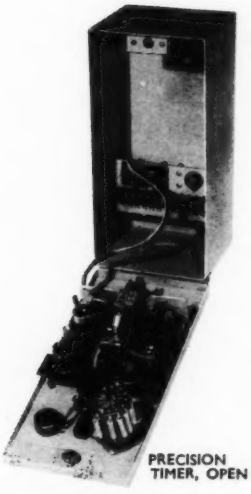

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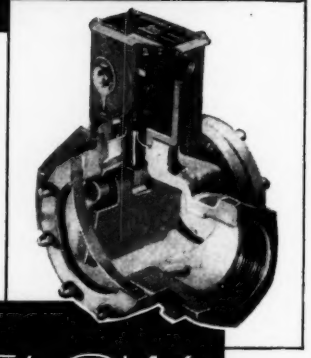

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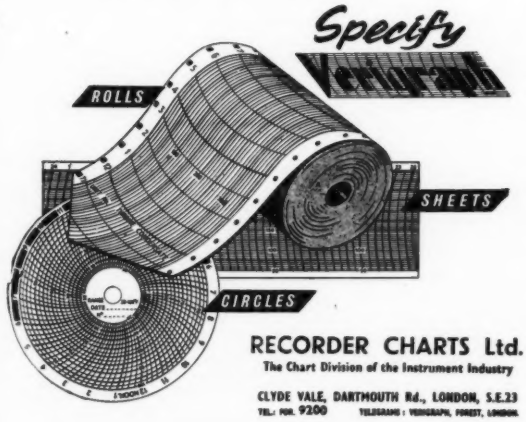

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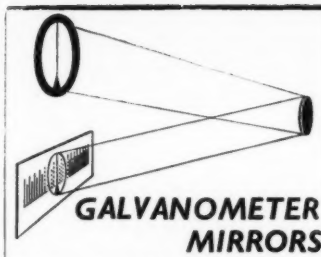

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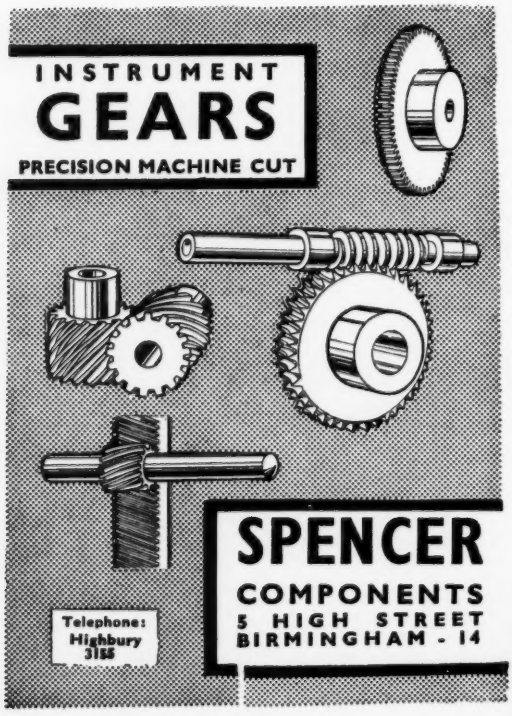

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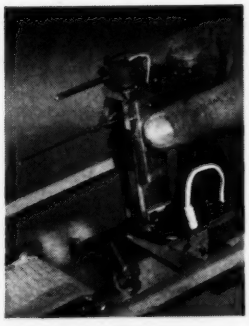

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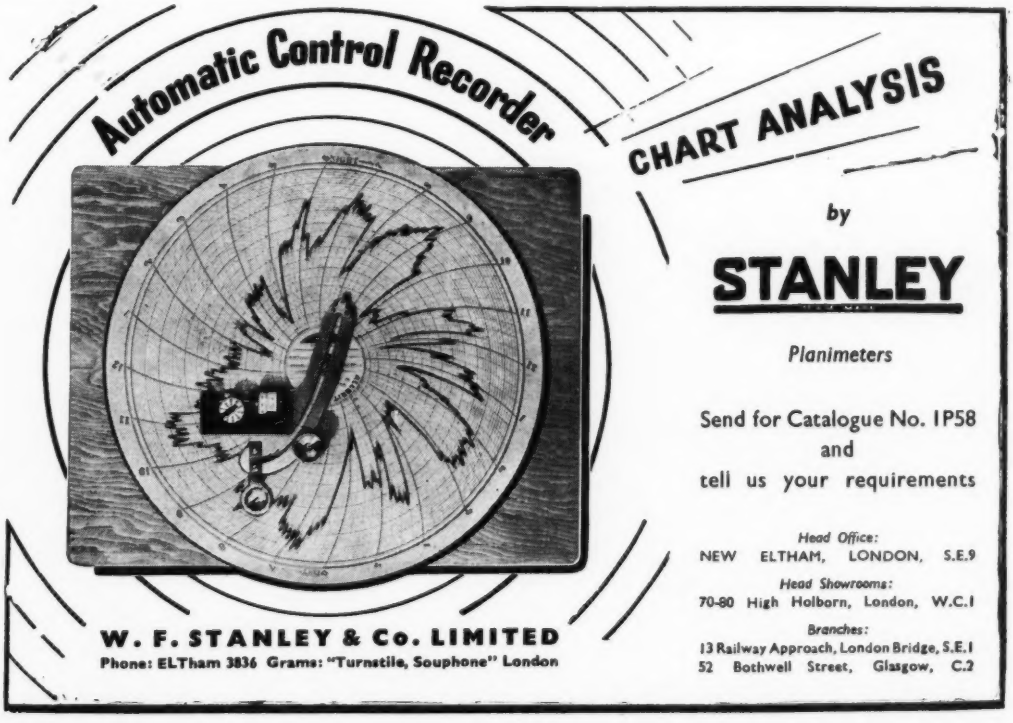

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